Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

JULY, 1961

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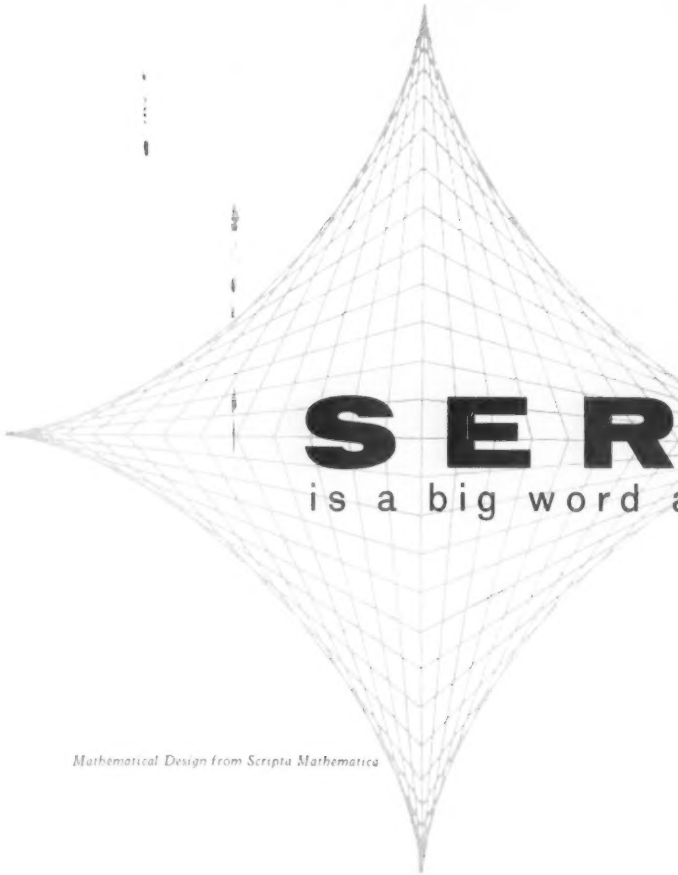
Institute of Metal Finishing Conference
Abstracts of Papers

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Read and pass on —

PLATING POWER BY DC POWER SPECIALISTS



Mathematical Design from Scripta Mathematica

SERVICE

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Whether it's technical advice or fast delivery RAPID'S entire organization is at your service.

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NOW FAST, LOW-COST
DEGREASING AT ROOM TEMPERATURE

Emulsion Cleaners 62 and 75 remove heavy oil films, solid dirt and buffing compounds at room temperature. Only a plain steel tank is required, eliminating costly vapor degreasing equipment.

Emulsion Cleaners 62 and 75 are safe for use on all metals and are ideal for a wide variety of jobs:

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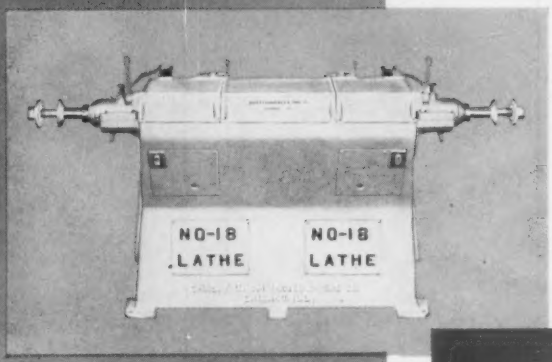
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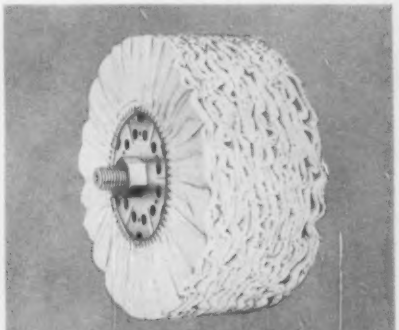
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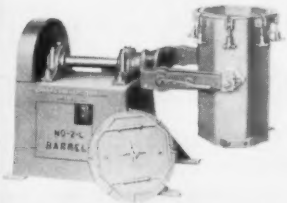


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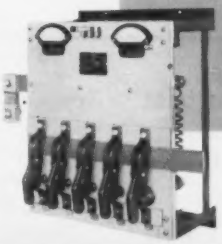
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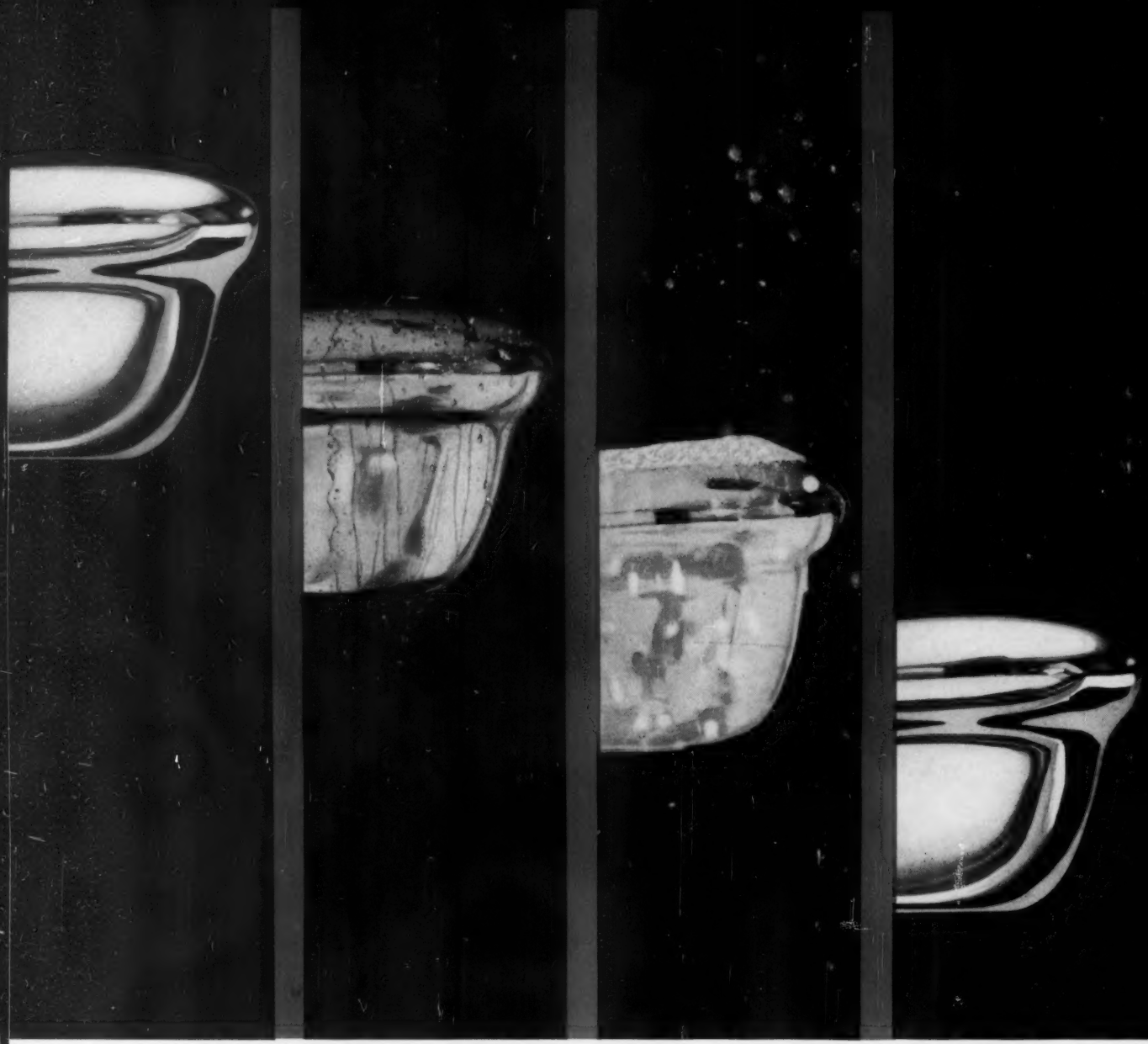


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By plating with M&T's "MICRO-CRACK" CHROMIUM, either in a duplex or single deposit, you outperform ordinary chromium not only on speed of deposition, but also on quality. A thickness of about 50 millionths of an inch over nickel gives better protection. The finish resists onset of blemishes far longer.

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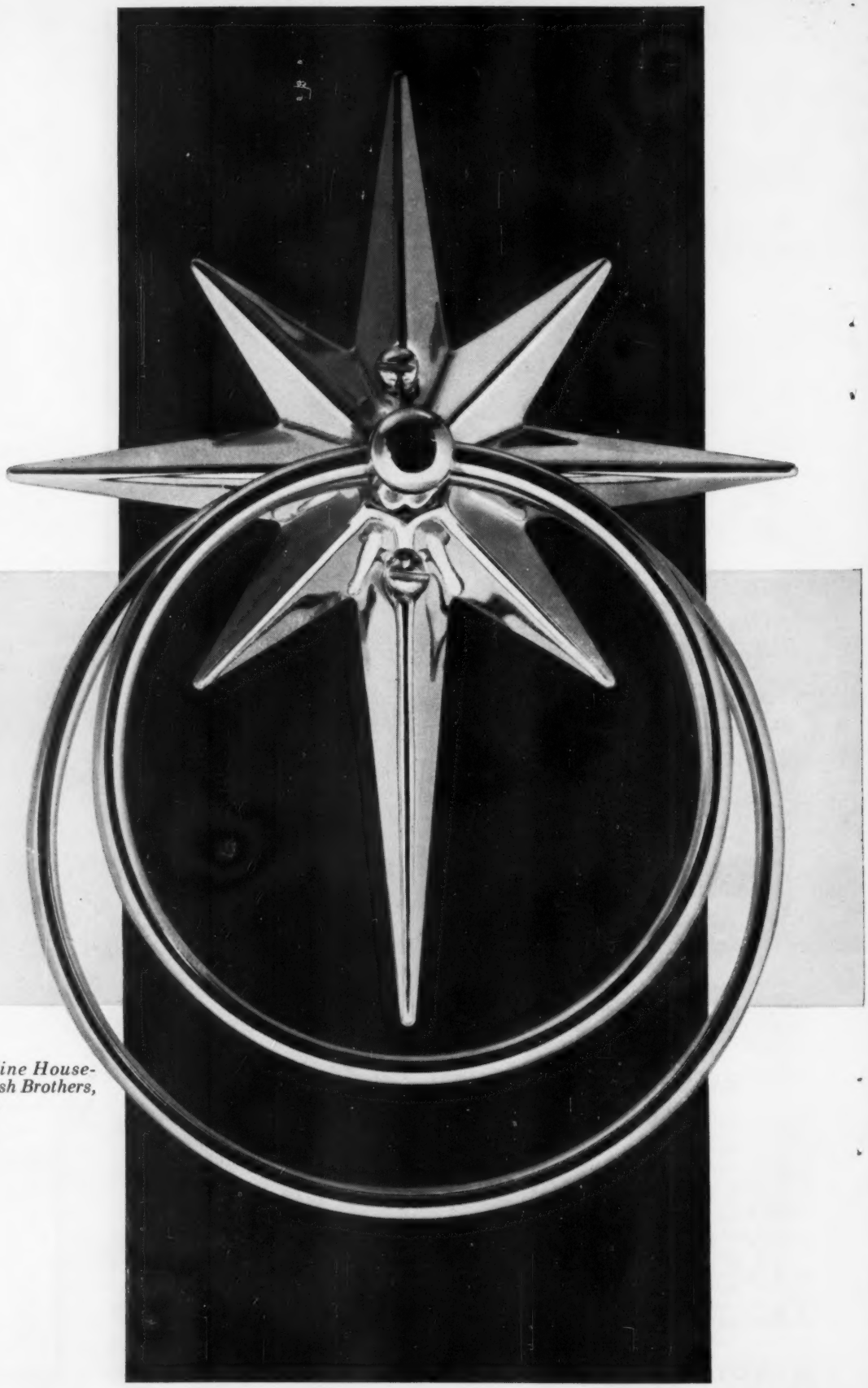
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NO DEGREASING
NO DEBURRING
NO COPPER PLATING
NO COPPER BUFFING
on this nickel-chrome plated fixture



...just chrome over
SUPERLUME
on a raw steel stamping

It used to take *six* operations to get the high-luster finish demanded by Starline Housewares for this chrome-plated towel ring. Now it takes only *two*.

Difference in finish quality? *Absolutely none*, agreed the plating experts who scrutinized random samples from batches produced both ways.

Maybe Superlume belongs in *your* plant, too. This high-leveling, super-bright nickel bath is economical with most die castings and virtually all high-grade steel products. For technical details on these and other money-saving uses, ask H-VW-M.

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how does your chrome plating stack up?

You can keep your chrome-plating process in step with today — with Diamond CPA 1800®.

For example: The CPA 1800 process is now being used in advanced jet engine experimentation — meeting the severest tests for corrosion and abrasion-resistance tolerances ever imposed on high-pressure seals.

This same jet-proven additive is available to you and to your chrome-plate source. To increase plating speed and covering power. To allow a broader operating range. To simplify anoding and produce a brighter, harder coating. To improve the metallurgical characteristics of chromium plate.

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MODERN CROWN "MP"

aids production at Smith-Corona Marchant

Many companies like Smith-Corona Marchant are daily maintaining quality plating and meeting production schedules with CROWN M.P. (multi-purpose) custom designed mechanized plating machines. At Smith-Corona Marchant one CROWN M.P. Automatic does the zinc plating while another CROWN M.P. handles the nickel and chrome plating of thousands of precision typewriter parts every day.

Mechanizing and automatic programming of your plating department can easily be the key to stimulating profits by—reducing costs—increasing production—and improving quality—for processing of barrel or rack type work—write for Bulletin M.P.

CROWN

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6 WAYS TO SAVE MONEY IN YOUR DEGREASING OPERATION

...from the makers of COLUMBIA-SOUTHERN TRICHLOR

1. Keep your solvent in the machine

Your solvent can't clean much metal when it's floating around in the air. Prevent drafts which remove solvent. Check open doors, windows and location of fans. Keep cover on unit during idle periods—solvent evaporates whether it's hot or cold.

2. Don't waste heat

By keeping your heating and condensing coils clean, you can operate your equipment at the design rate and thus control resultant waste of solvent and heat. Make sure the thermostats are kept clean and functioning properly.

3. Make sure your solvent is formulated for the job

Columbia-Southern Trichlor contains a special neutral stabilizer which enables it to stand up under continuous operation with high contamination rates. Trichlor's stabilizing system is designed specifically to permit you to handle aluminum as well as other metals safely in the degreaser.

4. Establish good cleanout procedures

Keep an eye on sump temperatures, and distill in time to avoid excessive contamination and low heat transfer. You not only get more efficient operation, but you may also save your equipment and reduce operating costs.

5. Protect equipment investment with scheduled maintenance

Schedule routine maintenance on valves, pumps, piping, gaskets and water separator; regular attention to little items prevents emergency repairs to the whole system.

6. Keep down dragout losses

Handle and rack your work properly. We often find that the type, shape and weight of parts going through machines are not given proper consideration. Liquid solvent may be trapped or vapor levels dropped as a result. A review of these factors, plus location of sprays, and throughput speed can reduce waste by a healthy figure.

These simple but effective rules have been developed by the Technical Service group at PPG's Chemical Division, as a result of hundreds of service calls and years of experience in applying Columbia-Southern TRICHLOR to degreasing operations.

Trichlor is built for the job, starting with a "triple-check" quality control system during manufacture. The stability, uniformity and purity of Trichlor are guarded by the blending in of carefully compounded *neutral* stabilizing agents which maintain the solvent in a safe, effective state through the toughest service.

Save money in your vapor degreasing operation by following the six rules above and specifying Columbia-Southern Trichlor. Call your nearby Trichlor distributor or the Columbia-Southern office serving your area.

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FULLY AUTOMATIC
PLATER & ANODIZER

Conveyor Breakdowns Eliminated with new electro-mechanical control and safety device. Racks can't be pushed into sides of tank; load can't drop if power fails during work transfers.

Positive 6-Point Connections. Self-cleaning heavy duty contacts need little or no attention.

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Fast Cycle Changes by shifting tank partitions and moving pick-up heads.

No Extra Headroom Required. All elevating mechanism operates below top of rack carrier.

Automatic Loading And Unloading of racks.

Delayed Set-Down to operate automatically with cycle. Furnished if required for conversion coatings and bright dips.

If More Than One Cycle is necessary, by-passing can be built in.

Hydraulic operation, standard.
Pneumatic operation, optional.

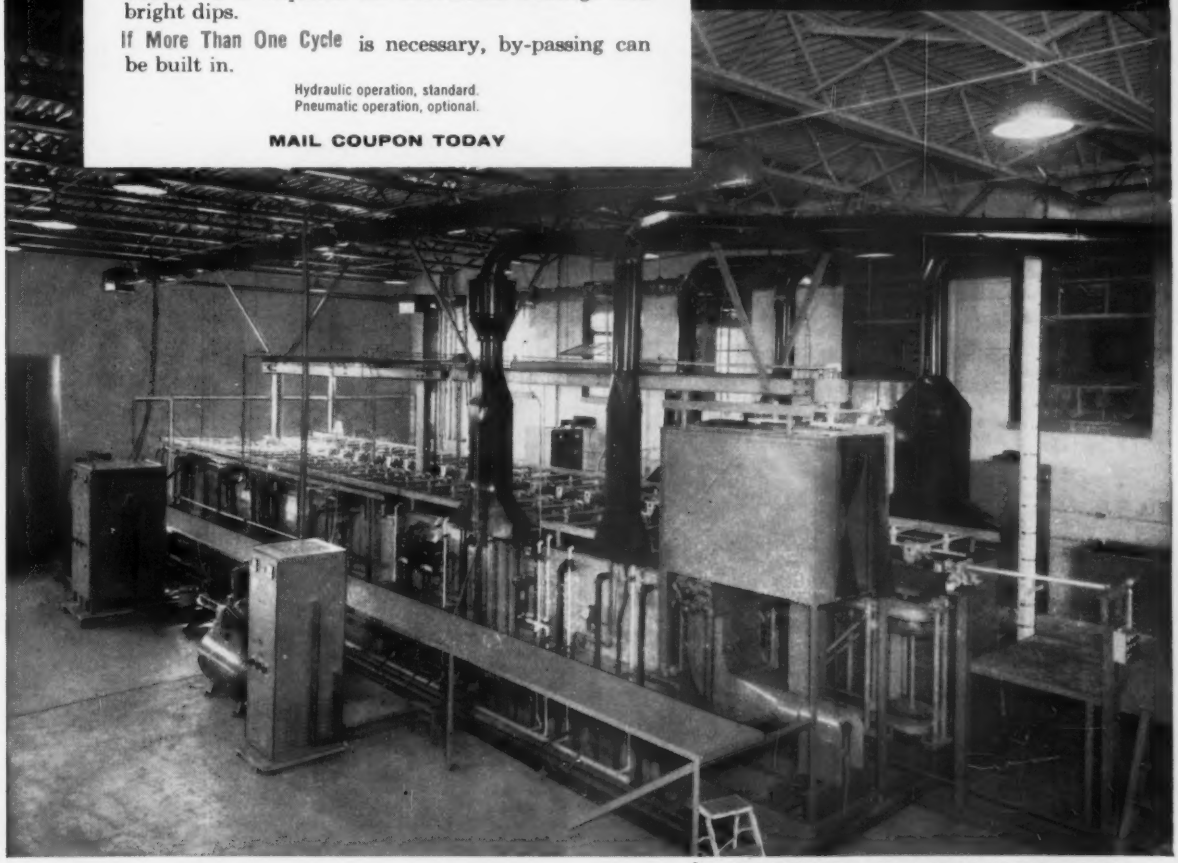
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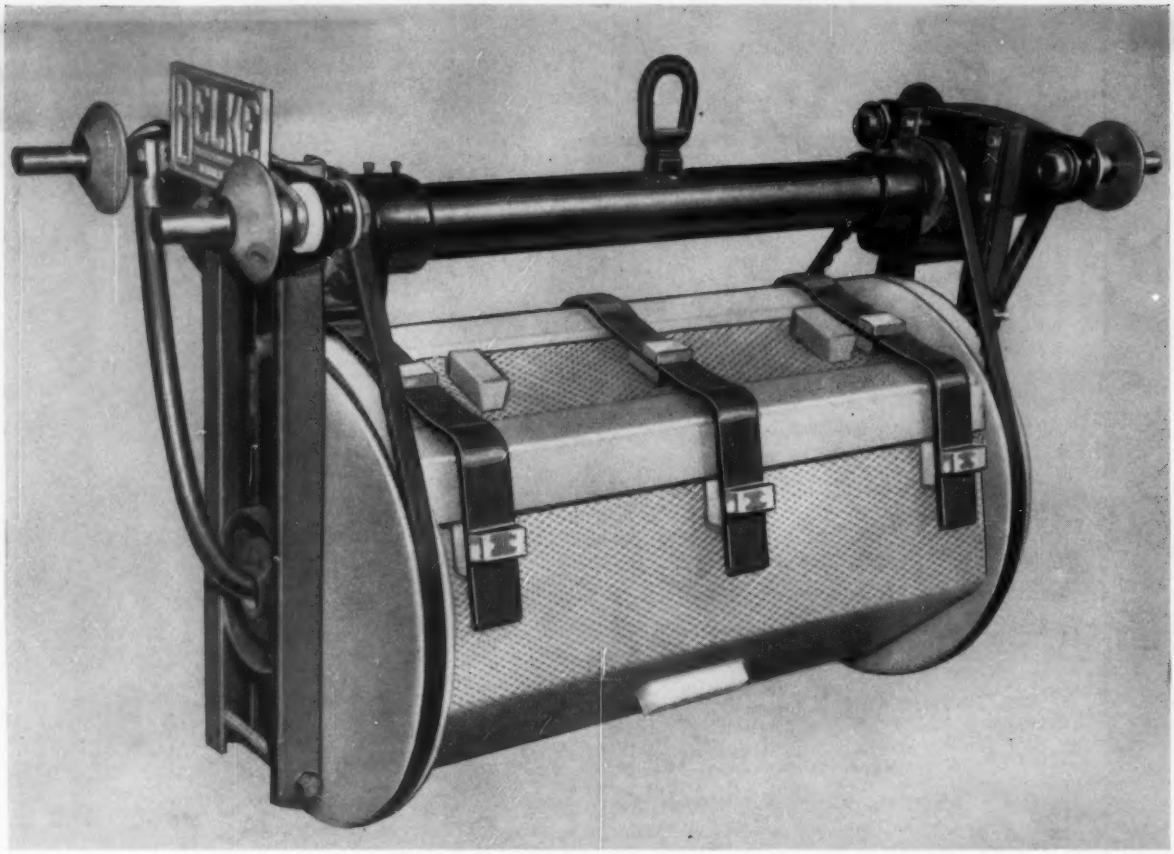
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ATTACH TO COMPANY LETTERHEAD

Send complete information on fully automatic Cycleflex

Name.....

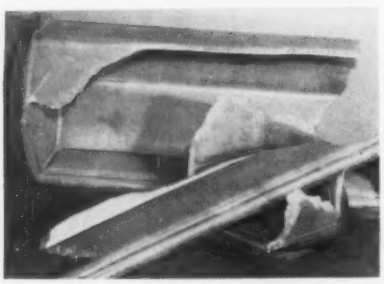
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All have set new industry performance standards.

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ASARCO





H-VW-M duplex plating cuts rejects 28% ... cuts costs besides

Collis Company of Clinton, Iowa, found a way to satisfy exacting customer demands, get better product appearance, cut rejects and greatly improve corrosion resistance by switching from copper-nickel-chrome to H-VW-M duplex plating. Collis found that two nickel baths (plus chrome) cost no more.

Superintendent of Finishing Walter R. Barrett switched to Levelume 220 as a top coat over Permalume for Collis' freezer racks and other wire goods and got these advantages:

- Rejects down 28%. No treeing, no pitting, a much more uniform plate
- Over 25% lower brightener costs
- 12¢ per lb. of nickel deposited with Permalume
- 18¢ per lb. of nickel deposited with Levelume 220

Mr. Barrett adds: "Duplex plating's the answer to higher corrosion resistance and better looks. For *superior* duplex at lower cost, it's Permalume and Levelume 220."

For further evidence, contact H-VW-M.

H-VW-M *Progress in metalfinishing through advanced processes • equipment*

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cleans steel after spot welding!

Hubbard-Hall's new 450 cleaner **often eliminates an entire operation.** One plater skips acid pre-pickling because 450 removes the light weld and heat scale from his spot-welded fabrications. Another uses 450 to eliminate all pickling before automatic plating. Others who used to use two cleaners before finishing use 450 instead. Besides removing grease, oil, dirt and other shop soil 450 also removes mild rust and stain. This powerful cleaner produces exceptional penetrating and soaking action. It's also low sludging, even when scale or rust is being removed, and absolutely non rusting.

Put Hubbard-Hall's new 450 cleaner to work for you. Write today for our bulletin containing complete information . . . then let us show you what 450 can do right in your plant.

PLANNED SERVICE *for better metal finishing*

THE Hubbard Hall CHEMICAL COMPANY • Waterbury, Conn.

STEVCO PROCESSES AND SUPPLIES *mean a brighter future for electroplating*

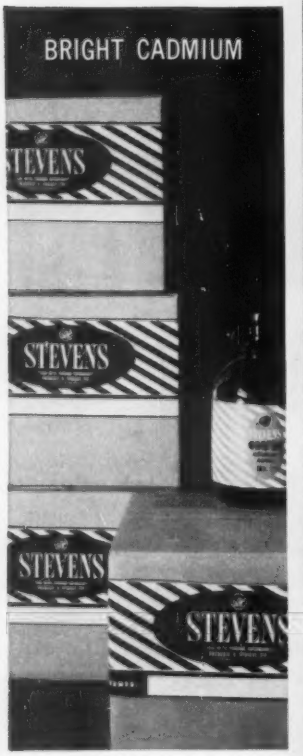
STEVENS EXPANDED MANUFACTURING FACILITIES now provide several superior plating processes, each field-proven and certified by the famous Stevens name.

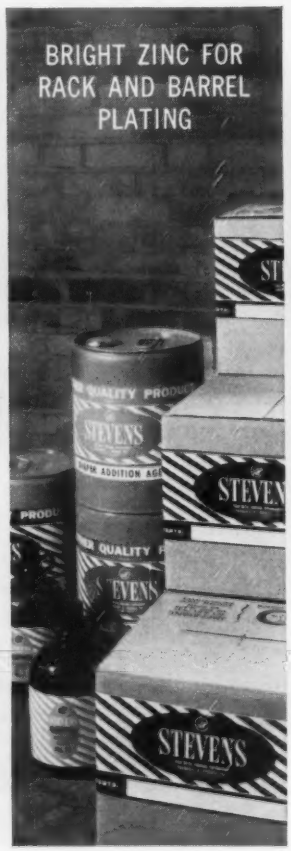
A GREATLY-ENLARGED CUSTOMER SERVICE LABORATORY permits accurate analysis and checking of solutions on a much broader scale than ever before. A skilled staff is available for immediate research assistance on all your plating problems.

STEVENS FIELD SERVICE TEAM has been increased by a number of well-qualified metal finishing technicians to give you fast, dependable on-the-job service, process and equipment recommendations.

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FOR IMPROVED PERFORMANCE in bright zinc, cadmium and copper plating processes, call your Stevens Representative for complete information. Write today for our informative brochure on prices, packaging and descriptive specifications.









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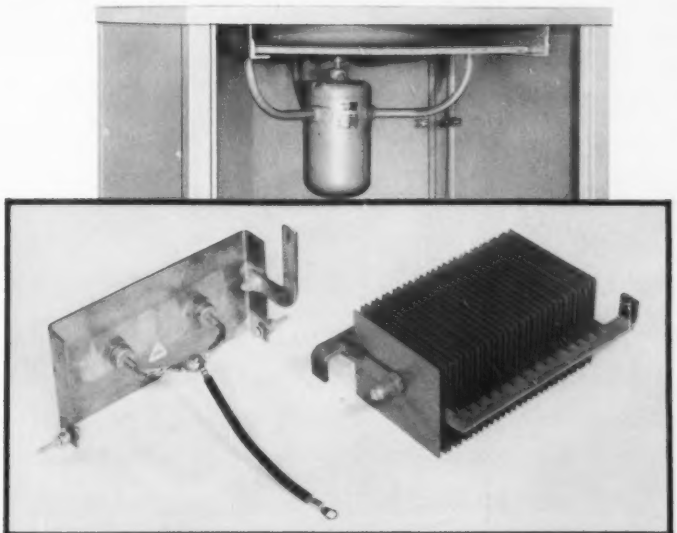
Allied Research

RECTIFIER CONVERSION KITS

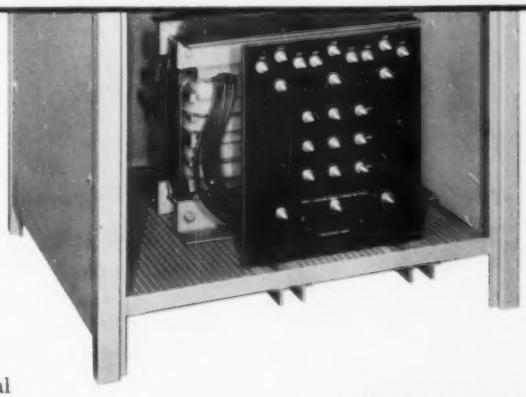
convert your old selenium rectifiers to modern, silicon rectifiers.

Now, with the Allied Research Conversion Kit, you can get important silicon rectifier advantages for just a fraction of the cost of a new silicon rectifier.

Check these features to see how you can improve your operations at minimum cost.



Give your old rectifier new life by replacing old stacks with efficient silicon diodes. Conversion kits available for most models of selenium and magnesium-copper sulphide rectifiers.



MORE EFFICIENCY

Silicon diodes can give you up to 95% efficiency at full load conditions. And, this efficiency is protected by hermetically sealing the diodes.

MORE LIFE

Silicon diodes have an unlimited life potential under normal operating conditions.

LESS MAINTENANCE

Longer cell life means less maintenance, less down time for repairs or replacements.

BETTER OPERATIONS

Better output from your rectifier can mean better operations on the line, fewer rejects, greater production of quality parts.

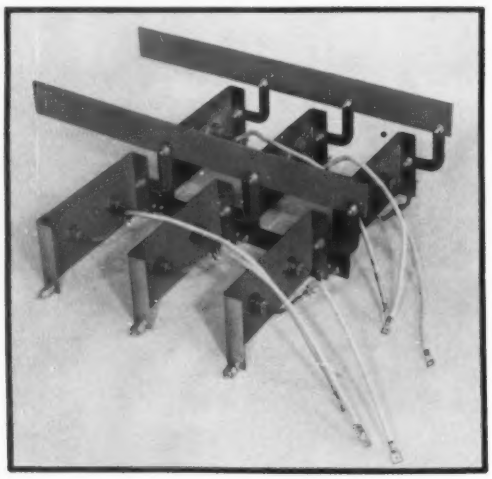
LOW COST

Low initial cost, plus the improved operations you get, mean the kit will pay for itself in just a short time.

EXCLUSIVE
DC PROTECTIVE DEVICE INCLUDED

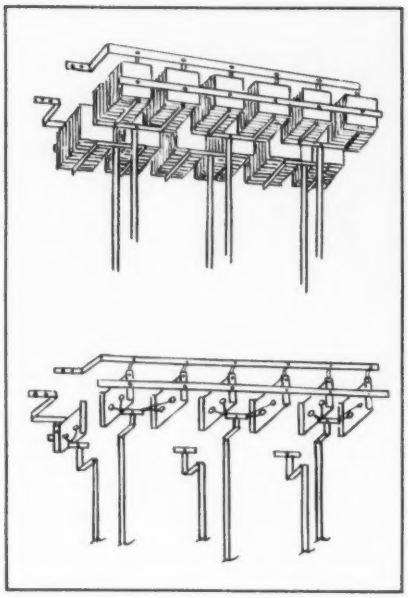
An important extra available only with Allied Research Conversion Kits—at no extra cost—is a unique device that protects your rectifier against damage by shutting it off should an external short circuit or excessive loading occur.

COMPLETE, EASY-TO-INSTALL KIT ALLOWS YOU To Do-It-Yourself *and* SAVE MONEY



◀ Kit comes complete with silicon diodes mounted on copper bus bars ready for insertion, high temperature silicone rubber insulated cables with lugs on both ends, specially designed baffle plates for some units to insure proper cooling, an exclusive DC protective device, detailed instruction sheets and easy-to-read wiring diagram.

RECTIFIER AFTER CONVERSION—This sketch shows how kits are designed for easy and exact replacement of old stacks. You have no fitting problems—your rectifier is back in operation in as short a time as possible. ▶



Order Direct... START CUTTING COSTS AND IMPROVING OPERATIONS NOW!

To order your Allied Conversion Kit, simply send us the following information on each rectifier:

1. **Date of purchase.**
2. **Model number.**
3. **Serial number.**
4. **D.C. output voltage.**
5. **D.C. output voltage of any other rectifiers connected in series or parallel with rectifier to be converted.**

IF NAME PLATE IS MISSING

. . . send date of purchase, physical dimensions, transformer name plate data, (usually mounted on top of transformer), number of stacks and model number (usually printed on outlet plate) and D.C. output voltage.

A SPECIAL SERVICE—**If you prefer, Allied Research will convert your old selenium rectifier for you and at the same time completely check and overhaul the entire unit . . . all at a nominal cost.**

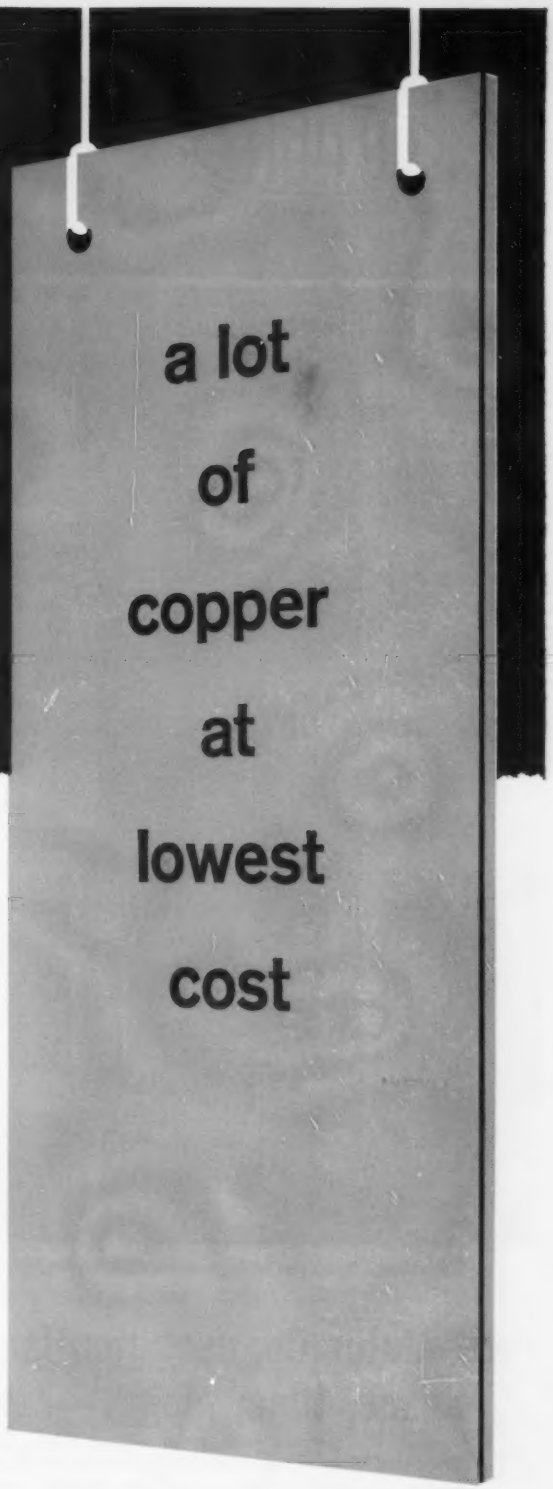
For more information, see your Allied Field Engineer, or write directly to:

Allied Research Products, Inc. 4004-06 EAST MONUMENT STREET • BALTIMORE 5, MARYLAND
BRANCH PLANT: 400 MIDLAND AVENUE • DETROIT 3, MICHIGAN
West Coast Licensee for Process Chemicals: L. H. Butcher Co. • European Agent: Sture Granberger, Storgatan 10, Stockholm, Sweden

Chemical and Electro chemical Processes, Anodes, Rectifiers, Equipment and Supplies for Metal Finishing

IRIDITE® Chromates | IRILAC® Coatings | ISOBRITE® Brighteners | ARP® Supplies | WAGNER Equipment

ANACONDA PURE COPPER *Electranodes*



Now . . . pure copper anodes available in the lowest price range! Developed solely for the plating trade, Anaconda Electranodes are produced from full 1″ thick electro-deposited copper.

QUICK FACTS

Economical—in the lowest price range of any copper anodes of similar thickness.

Highest Commercial Purity—made from virgin metal of 99.925% minimum purity.

Ample Thickness—to drill and tap holes for insertion of suspension hooks.

Oxygen-Free—suitable for both acid and cyanide plating.

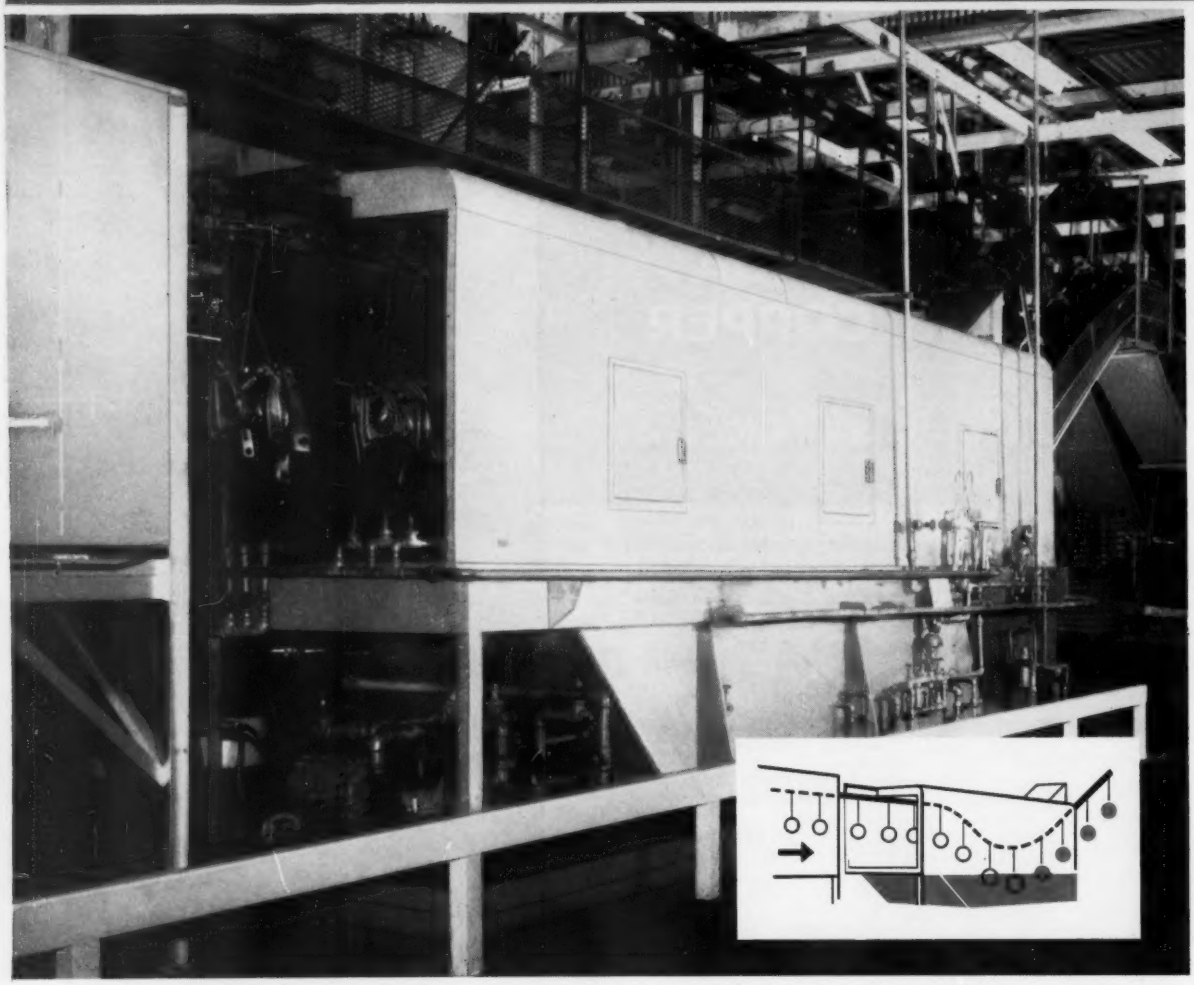
Dense Structure—no porosity.

Here, for the first time, is high-quality electrolytic copper available in full 1″ thickness that cuts handling time, lowers costs. Electranodes can be used in any plating operation where a flat anode will fill requirements. If you want an economy type anode, Electranodes offer you the finest quality at the lowest possible cost.

Write for Electranode Specification Form. We'll follow up with prompt price and delivery information on Electranodes to meet your specific needs. Address: Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 61-812

ANACONDA®
AMERICAN BRASS COMPANY

DU PONT TRICLENE® TRICHLORETHYLENE FINISHING NEWS



As shown, auto parts on a monorail conveyor are hot dip painted at Ford's Sterling, Michigan, plant.

Ford Motor Co. uses nonflammable "Triclene" Painting—saves space, time, money—can finish 24,000 parts per day

The Ford Motor Company wanted a safe, nonflammable, production-line method of painting front-end suspensions. The answer was the Du Pont "Triclene" Painting Process. This installation has been in operation for 4 years!

Because "Triclene" is nonflammable, fire hazard was reduced, and saved Ford Motor Company the cost of additional fire-protection equipment. Because parts emerge dry, no costly drying ovens or drip areas were required, which also resulted in substantial floor-space savings.

Quality production is maintained at a high level. Parts can move through the paint unit in one minute at a rate of over 2,000 an hour: 24,000 a day. They dry almost at once, leaving a paint film of excellent coverage and uniformity. Parts are immediately packed and shipped to the assembly plant.

"TRICLENE" Finishing is a revolutionary new way to finish metals. Clean, phosphatize and dip or spray paint continuously in a single medium of nonflammable "Triclene" trichlorethylene. Use processes singly or in combination to suit any metal finishing need.



Check these important advantages of "TRICLENE" Painting

- ***NONFLAMMABLE.*** "Triclene"-thinned paints increase safety . . . minimize fire hazards. Need for expensive fire-protection equipment is eliminated, and insurance premiums are often reduced.

- ***SAVES SPACE.*** No drying ovens needed where lacquer-type paints are used. Drip pans aren't required, either. "Triclene" Painting installations generally require less than half the space required by conventional methods of production-line painting.

- ***ECONOMICAL.*** No overspray or drip losses means that all paint bought is used effectively. This can cut operating costs as much as 30%.

- ***VERSATILE.*** "Triclene" method of painting can be done by hot dip or spray-in-vapor cycles. Method can be combined readily with "Triclene" Vapor Degreasing and/or Phosphatizing Processes.

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

Consult these manufacturers for "Triclene" thinned paints

Paint manufacturers listed below offer "Triclene" thinned paints for use in Du Pont "Triclene" painting systems. Contact the one nearest you for further information or send the coupon below for details.

Allied Materials Corporation . . . . . Detroit, Mich.
Allerton Chemical Company . . . . East Rochester, N.Y.
American-Marietta Company . . . . . Chicago, Ill.
The Arco Division
American-Marietta Corporation . . . . . Cleveland, Ohio
Armstrong Paint & Varnish Works, Inc. . . Chicago, Ill.
Baltimore Paint & Chemical Corp. . . . . Baltimore, Md.
The R. A. Becker Company . . . . . Cincinnati, Ohio
Boydell Brothers Company . . . . . Detroit, Mich.
Bradley & Vrooman Company . . . . . Chicago, Ill.
Dibble Color Company . . . . . Detroit, Mich.
Felton Sibley & Company . . . . . Philadelphia, Pa.
Finishes Division
E. I. du Pont de Nemours & Co. (Inc.) . Wilmington, Del.
Frost Paint and Oil Company . . . . . Minneapolis, Minn.
Hanna Paint Manufacturing Co. . . . . Columbus, Ohio
Jamestown Paint & Varnish Co. . . . . Jamestown, Pa.
Lacquer Products, Inc. . . . . Cleveland, Ohio
Maas & Waldstein Company . . . . . Newark, N. J.
Midland Industrial Finishes Co. . . . . Waukegan, Ill.
The O'Brien Corporation . . . . . South Bend, Ind.
Pontiac Varnish Company . . . . . Pontiac, Mich.
Pratt & Lambert, Inc. . . . . Buffalo, N.Y.
Rinshed-Mason Company . . . . . Detroit, Mich.
The Sherwin-Williams Company . . . . . Cleveland, Ohio
Smith Davis Company . . . . . Los Angeles, Calif.
Tousey Varnish Company . . . . . Chicago, Ill.
Varnish Products Company . . . . . Cleveland, Ohio
Wyandotte Paint Products Co. . . . . Wyandotte, Mich.
Wyco Paint & Chemical Co. . . . . Birmingham, Mich.

E. I. du Pont de Nemours & Co. (Inc.)
Electrochemicals Department
Chlorine Products Division
Wilmington 98, Delaware

☐ Please send literature on "Triclene" painting.
☐ Please send us details on how we can begin an evaluation program on trichlorethylene painting. We are now painting_____

Name_____

Position_____

Company_____

Address_____

City_____ State_____



Nickel-Chrome Plating shines through the years of wear she'll give this bicycle

Nickel-Chrome Plating is more than a match for the hard wear that means bicycling fun for youngsters. It's beautiful, it's durable—*and stays that way*—despite rain, dust, bumps and scratches.

Rugged resistance to corrosion and lasting protection for the basis metal are why the manufacturers of this beautiful bicycle specify Nickel-Chrome Plating. It's put to work where wear is at its worst—on cranks, sprockets, wheel rims, fenders, handlebars and wire and tubular luggage carriers.

Nickel-Chrome Plating works so well with so many basis metals. It gives designers true flexibility in selecting basis materials for top performance, simplified fabrication, and practical production cost. And it gives metal finishers a coating system that protects the product for years of rugged wear.

Plan to use Nickel-Chrome Plating. Automotive trim...large and small appliances...hand plumbing fixtures...almost any product can have a durable, attractive finish—no matter what basis metal or fabricating method is used. For more information on decorative plating, write for your copy of "The Contribution of Nickel and Chromium to the Durability of Decorative Plating."

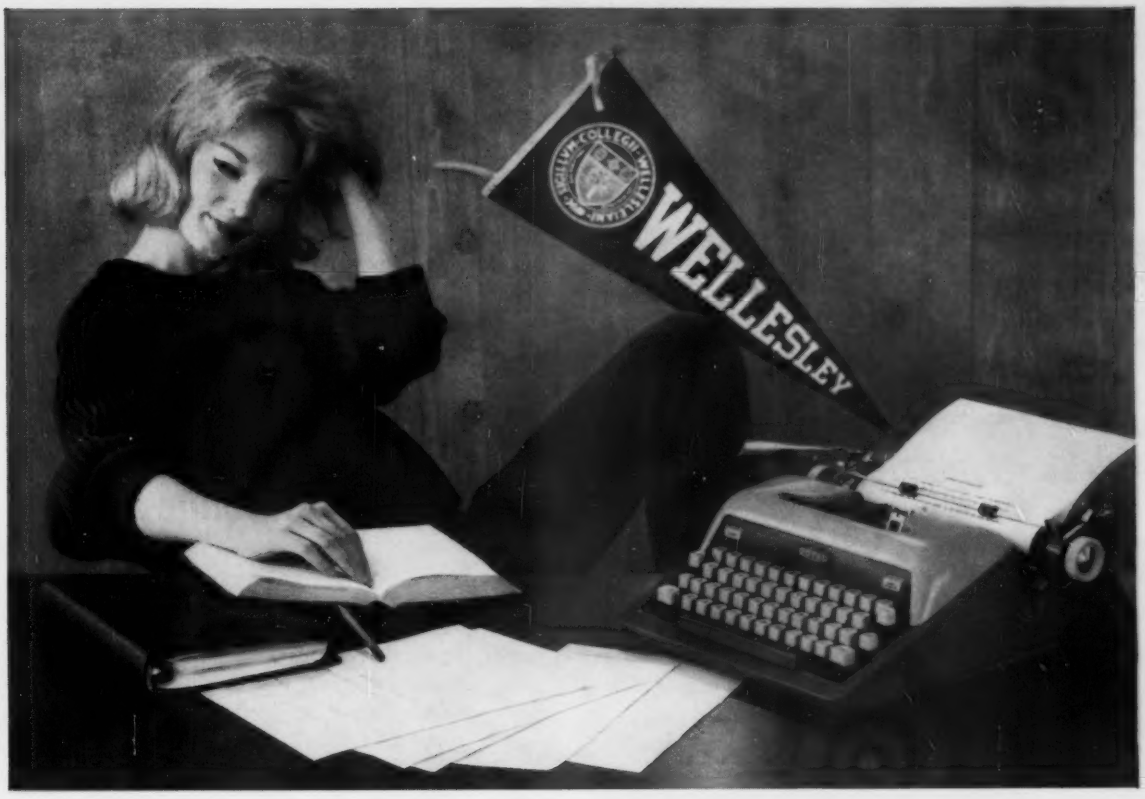
The International Nickel Company, Inc.
67 Wall Street INCO **New York 5, N. Y.**

Inco Nickel

Nickel makes plating perform better longer



Arrows indicate where Nickel-Chrome Plating is used for shining good looks and rugged service.



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...She's concerned about the theme due next week. Never any doubt about the performance of her ROYAL PORTABLE which she "beats" on the average of 20 hours a week. Reliability's taken for granted—the greatest compliment you can pay any product.

Royal McBee Installs 2 Meaker Automatic Plating Machines to Process Over 150 Royal Portable Typewriter Parts

Much of the taken-for-granted reliability for which ROYAL PORTABLE TYPEWRITERS are famous is due to the precision plating of over 150 components done on 2 MEAKER AUTOMATIC PLATING MACHINES. One unit takes care of the entire production requirements for chrome plating — plus an equal amount of nickel plated parts. The second MEAKER plates over 100 different components in bright or "black" zinc.

Reports Mr. C. H. Farrington, Production Manager of Royal McBee's new "showplace" plant in Springfield, Mo.: "We particularly like the custom designed automatic programming on our MEAKER. We plate nickel and chrome or just nickel on one unit, and either bright or "black" zinc on the other, in any sequence desired."

Since 1899, THE MEAKER COMPANY has designed and built automatic equipment for continuous or batch-type metal finishing for large or limited production requirements. Our experience has shown that many medium size shops can pay for a MEAKER AUTOMATIC in labor savings and consistent quality production alone.

Our latest catalog "WHEN TO AUTOMATE" will give you some valuable ideas on improving your profits picture through automatic metal finishing or plating.

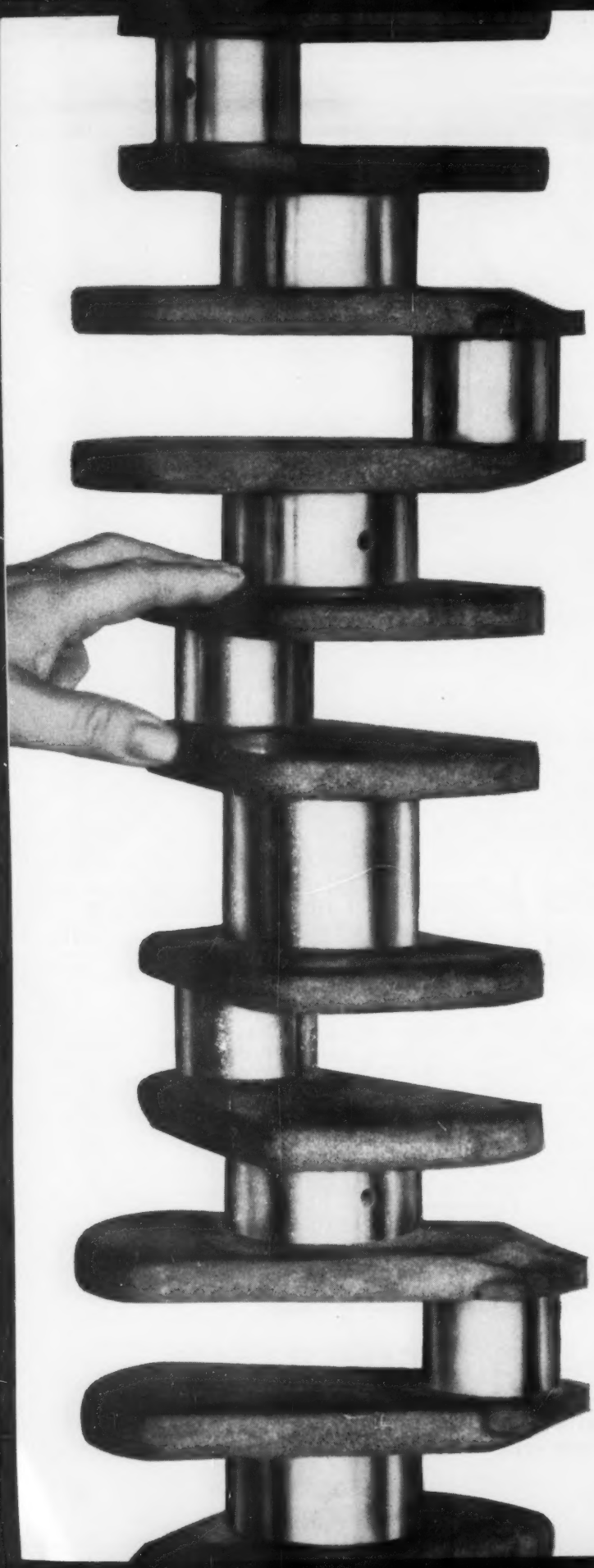
MEAKER 1899

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SUBSIDIARY OF SEL-REX CORPORATION

Nutley 10, New Jersey

Factories and offices Chicago 50, Ill., Los Angeles, Cal. and Nutley 10, N. J.



Simmons Plating puts "more drive" into crankshafts with Mutual Chromic Acid

Simmons Plating Works, Atlanta, Ga., adds years of service to crankshafts for rebuilt engines by hard chrome plating with Mutual® Chromic Acid. Famed throughout the Southeast as "Mr. Chrome," Simmons attributes its success to high standards, skill and Mutual Chromic Acid.

Mutual Chromic Acid is always 99.75% pure —or better. Its consistently low sulfate content helps Simmons control the acid-sulfate ratio of their plating bath. This safeguards against plating difficulties—and expensive rejects!

To learn more about the Mutual line of chromium chemicals, write for your free copy of Solvay's 80-page Technical Bulletin, "Chromium Chemicals." Our Technical Service staff will gladly answer your questions. State whether you would like to have a representative call.

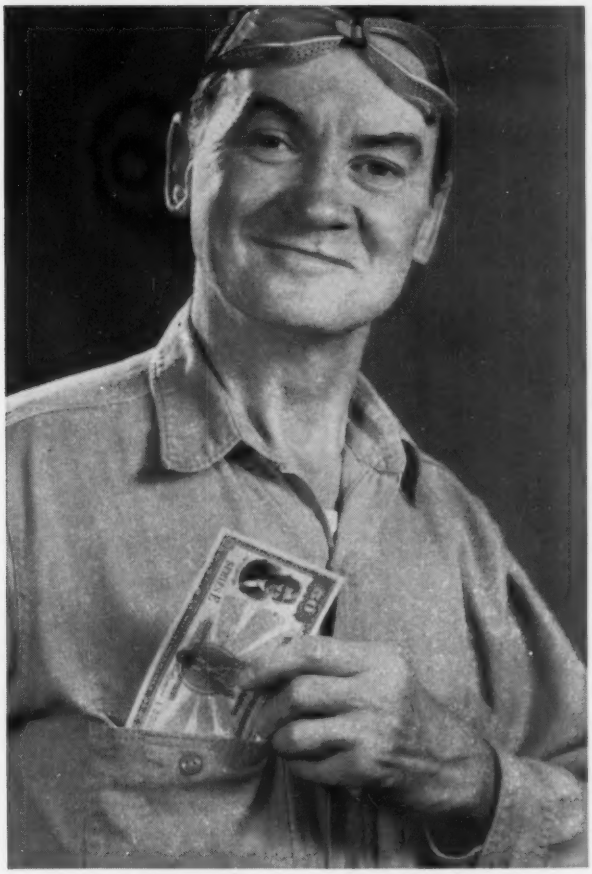
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61 Broadway, New York 6, N.Y.

How 45,000 companies help their employees buy security



45,000 American business firms have put in a valuable service for their employees—the Payroll Savings Plan for U.S. Savings Bonds. Through this plan the company payroll clerk sets aside a certain amount for each participating employee, each payday. Bonds are delivered to employees as soon as they are fully paid for. It's fully automatic, and the easiest way in the world to save.

More than 8 million employees are using the plan, and are saving about $2 billion in Savings Bonds a year. These funds have helped buy homes, finance vacations, assure college educations and provide nest-eggs for retirement.

If your company has not installed the Payroll Savings Plan thus far, contact your State Savings Bonds Director and have him show you how the Plan works. Get his experienced help in presenting the Plan to your organization. Or write Savings Bonds Division, U.S. Treasury Department, Washington, 25 D. C.

Hats off to American Industry!

"American Industry—by promoting the Payroll Savings Plan—has given the Savings Bonds Program its greatest success," says William H. Neal, National Director of the Treasury's Savings Bonds Program.



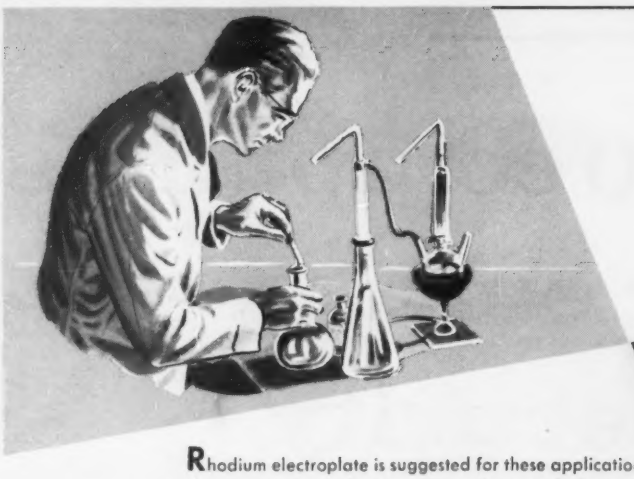
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20th ANNIVERSARY 1941 1961

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Rhodium electroplate is suggested for these applications: on wave guides and microwave equipment which may be used in marine atmosphere; in printed circuits; in electrical contacts where light contact pressure and low voltages are involved... Rhodium is very hard and corrosion-resistant.

This Rhodium plating solution is easy to use. It operates over a wide range of temperatures and current densities. We will be glad to plate samples without charge.



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NAPCO'S MITEY-MITE PLATER (only barrel of its kind) Small loads are no longer a problem. Just load MITEY-MITE, place in your barrel and plate. Contact is made thru the work load, into a small dangler and into the MITEY-MITE. Every plater will find MITEY-MITE's quick load and unload features essential. Can be ordered in a set of 3 or a single unit —Sizes 6" - 4½" - 3".

NAPCO'S FULL CYCLE PLATING BARREL . . . . With Plastisol covered hanger arms, 3/32" standard perforations, danglers, polypropolene ring gears and gear train, coated and uncoated superstructures. Barrel materials available in, Polypropolene, Lucite, Melamine, Bakelite. Complete stock sizes—14x30 - 14x32 - 14x36 - 15x30 - 15x36 - 16x30 - 16x36 - 18x36.

NAPCO maintains a department with complete replacement parts for ALL manufactured barrels. All items complete manufactured in our plant. (Dealers inquiries invited)

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brand new from top to bottom . . .

Ultrasil *rectifiers*

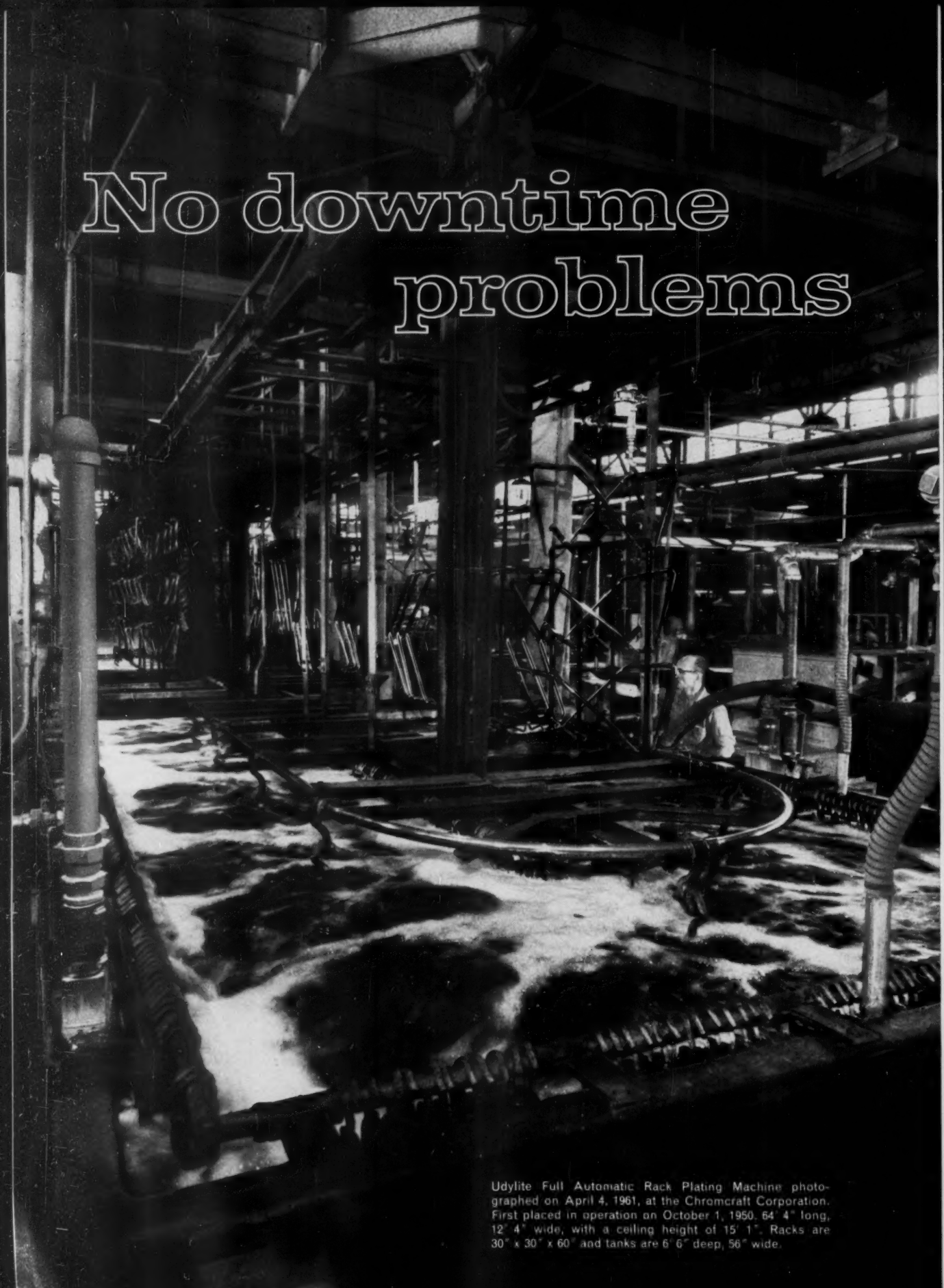
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Detroit 11, Michigan

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Udylite Full Automatic Rack Plating Machine photographed on April 4, 1961, at the Chromcraft Corporation. First placed in operation on October 1, 1950. 64' 4" long, 12' 4" wide, with a ceiling height of 15' 1". Racks are 30" x 30" x 60" and tanks are 6' 6" deep, 56" wide.

in ten years!

Udylite Full Automatic plates 13 miles of tubing per day for metal furniture leader!



"Our Udylite Full Automatic Rack Plating Machine has more than met extremely heavy production schedules over the last 10-year period—without any significant downtime other than process change-over," states Mr. Irwin C. Keefer, Vice President of the Chromcraft Corporation, St. Louis, Missouri. ■ A leader in the metal furniture industry, Chromcraft Corporation produces more than 500 tables and 3,000 chairs per day. Tubular metal legs and frames are first bright nickel plated in a Udylite Incomparable "66" Process bath. Later they are chrome plated or finished with a gold aniline epoxy coating. ■ "We selected this return-type automatic on the basis of successful past performance of our other Udylite equipment. The need for increased production with uniform high plating quality, ease of operation and reduced maintenance requirements were additional considerations of importance," continues Mr. Keefer. ■ To find out how a Udylite Full Automatic, engineered to meet your specific plating requirements, can improve your production and profit picture, contact your local Udylite Representative, or write:

Udylite

THE UDYLITE CORPORATION
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UP TO 48% GREATER EFFICIENCY!

IMPERIAL PLATING BARRELS

WITH NEW "FIN" DESIGN



An important "first" from Imperial! In actual tests against standard plastisol-coated steel plating barrels, an Imperial all-plastic barrel with the exclusive "fin" design *increased plating thickness 48%*. The secret is reduced electrical resistance and more thorough agitation and uniform circulation in the plating solution.

Imperial manufactures higher-efficiency plating barrels in a wide range of sizes, materials, and models. They are 100% interchangeable with the standard barrels on your automatic plating machines. Barrels illustrated are made of polypropylene (*first* used for barrels by Imperial several years ago) or COPOLEFIN—a special olefin copolymer. Features: Sturdy, all-welded and reinforced construction; great resistance to chemicals, stress, impact, abrasion, heat; long service life; light weight; and low cost. They stand up under all solutions and temperatures. The units are also available in high-temperature Plexiglas and other materials, on special order.

Imperial makes horizontal belt and gear driven barrels to fit your existing plating equipment, as well as plastic tanks, ducts, hoods, and other custom-fabricated parts.

All barrels are backed by years of manufacturing experience — plus a warranty. Write now for free literature.

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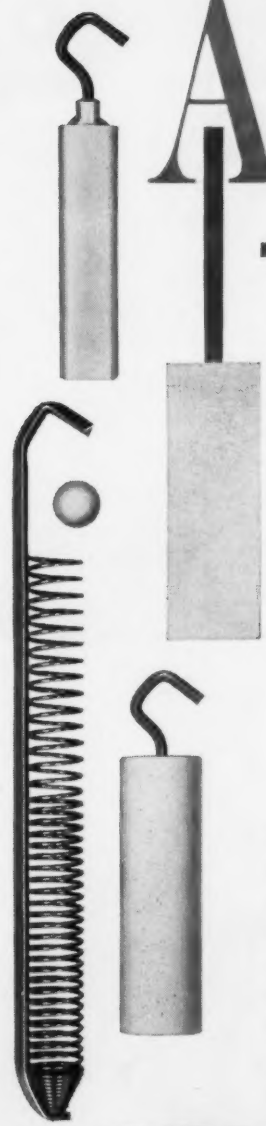
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BALL ANODES—2″ diameter.

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Oval, hex and slab anodes are available drilled and tapped or with steel strap hook through entire length of anode. Udylite anodes have the highest purity available, are of a special high grade zinc and meet all government specifications. Ball anode containers are manufactured in both straight and curved types. Call your Udylite representative the next time you order zinc anodes. Or, order directly from:

Udylite

world's largest plating supplier

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Detroit 11, Michigan

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"You bet we read Metal Finishing

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— says Mr. M. H. Dent, Plating Shop Supervisor
Pan American World Airways Component Overhaul Base

MR. DENT HAS BEEN A PAID SUBSCRIBER SINCE 1942

"Our department has a great responsibility in the overhaul of aircraft and its engines," states Mr. Dent. "In piston engines, in particular, there is a great use of dissimilar metals in both the internal and external regions. We employ many metals on different steel parts that have become worn or misshapen in order to restore them for strength and dimensional fit.

"I find the feature articles in METAL FINISHING extremely useful in our work. In addition to being current and authentic, this material is also easily understood. I particularly like the Shop Problems Section, and the GUIDEBOOK is without equal because it serves as a replacement for an entire metal finishing library. In fact, that is precisely what it does. Whenever I travel to our affiliate bases in South America, I find a great demand for the GUIDEBOOK. On occasion I have reluctantly relinquished the copy I always have with me."

Mr. Dent has been an employee of Pan American since 1942. He has been an active member of the American Electroplaters Society since 1956.



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- METAL FINISHING offers advertisers and prospects complete marketing studies related to all aspects of the industry.

* $5.00 in U.S. and Canada; $15 Foreign.



at Pan American World Airways



PAN AM



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Illustrated is the pioneer base of the worldwide system of Pan American World Airways. Sprawled over 167 acres and occupying 29 buildings with nearly 1,500,000 square feet under roof, this is one of the world's largest and finest maintenance and operations bases for jet airliners and piston-powered aircraft.

Here is a self-contained community with a "population" of 5,000 year-round employees. This bustling city has its own uniformed police force and volunteer fire department, as well as a staff of doctors and nurses, a weather bureau, television station, a chemical and testing laboratory, and three cafeterias. Here the task of airframe overhaul for the airline's 400 million dollar fleet of jets has been assigned. Here are the men and equipment that keep the Clippers flying . . . an army of 3,000 skilled engineers, mechanics, technicians and inspectors, who, though seldom seen by the traveling public, share equal credit with Pan Am's flight crews for the airline's outstanding record of air transport pioneering and safe, dependable service throughout the years.

To sell your products and services to men like M. H. Dent of Pan American, you need ***METAL FINISHING*** *— the one publication top executives want to read and are willing to pay for!* ***EDITORIAL VITALITY:*** *METAL FINISHING is recognized as the engineering authority on finishes. Its editorial content is geared to the needs of the men in charge of finishing operations.* ***CIRCULATION STRENGTH:*** *With the May issue, METAL FINISHING renewals totaled 81.73%, an all-time high!* ***ADVERTISING ECONOMY:*** *Because there is no waste circulation in METAL FINISHING, every advertising dollar buys more key executive attention.*

Metal Finishing

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or 701 North Sangamon St., Chicago 22, Ill.

39 Years of Service to the Heating Treating and Metal Finishing Industry

another ***Singleton "First": Seilon Gears!***

THE NEW GEAR-DRIVE WITH THE MOST GUTS

and the Singleton Barrel proved it!



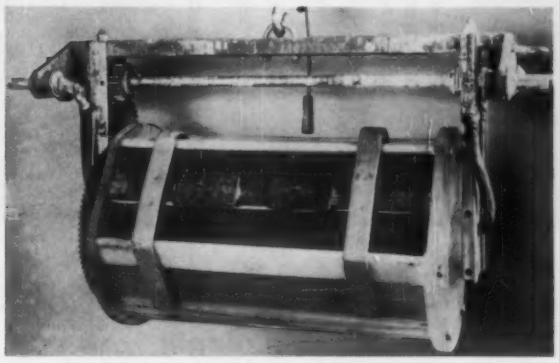
★ First universal application gear-drive for **all solutions** — to 220°F.

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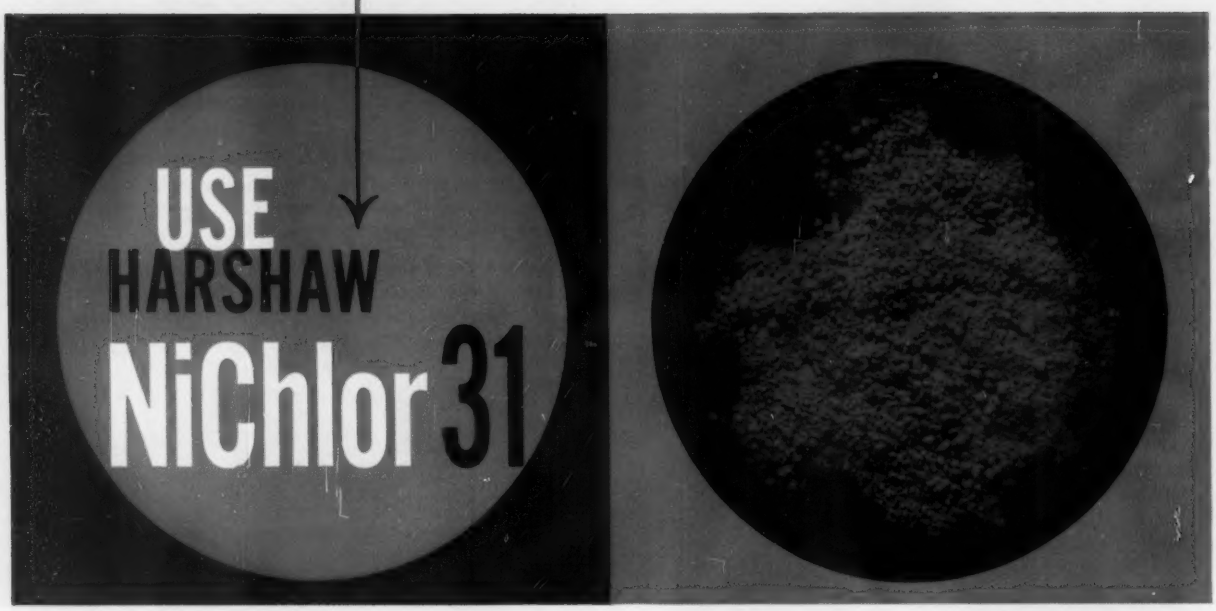
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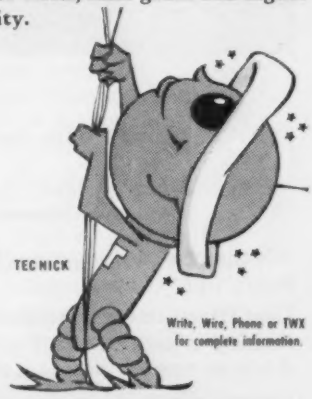
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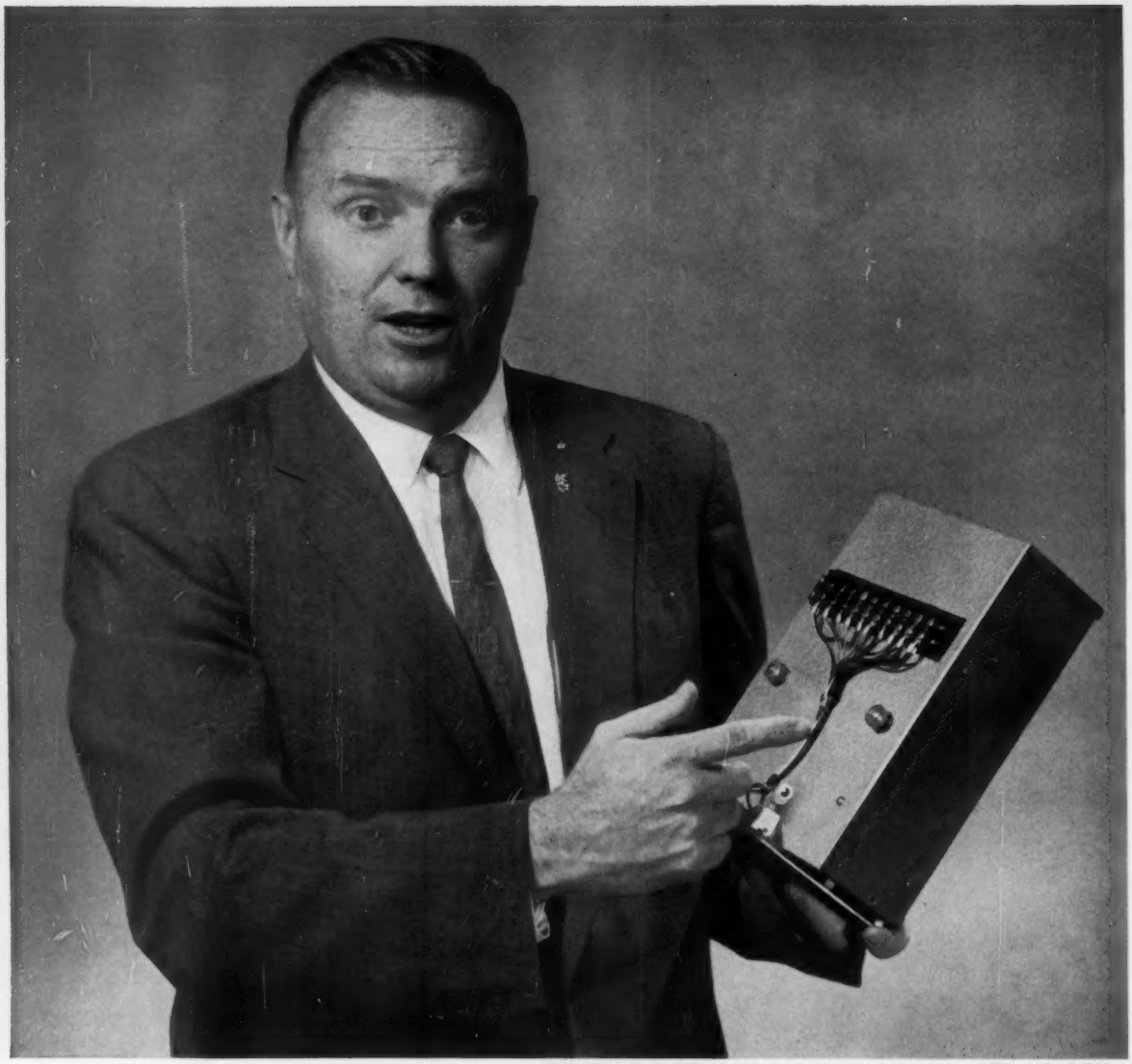
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BAKING THE FINISH

It is a source of never-ending surprise to the editor that, in this day and age, there should be so many users of organic finishes who have only the vaguest idea of what is involved in baking and what constitutes a baked finish. Some readers may be dismayed to learn that a sheet iron box with doors and a steam coil does not satisfy the definition of a baking oven, and that a clear nitrocellulose lacquer, force-dried at about 140°F., does not turn into a baked finish as a result.

Far be it from us to deprecate this type of drying, which is quite effective in avoiding dust spots on the wet film. However, as an alternative to the regular and thorough wielding of a vacuum cleaner in the lacquer room, it leaves much to be desired. Some types of baking finishes are really air-dry types and will continue to oxidize with time, but most depend on a chemical reaction at elevated temperature to develop their best film properties, and it is a misconception to believe that a baking schedule lends itself to haphazard control.

Basically, an oven comprises a chamber and a heat source, but it takes much more than that to produce a baked finish of quality. The heat must be distributed so that the temperature is uniform throughout the oven; in a convection oven this means a fan and suitable baffles, and in a radiant oven it means proper number of heating units and spacing. The temperature must be known, not estimated, because the tendency to underestimate is not uncommon. Some finishes will bake properly at 275°F., but a number of epoxies and phenolics will not develop full resistance at 300°, and plastisols require at least 350° to fuse well.

The finish manufacturer's specification is not subject to interpolation, so it is not advisable to push the first load of the day through before the oven is up to temperature, and an automatic start-up control may be necessary in order to obtain full production per shift. Ventilation must be provided to carry off excess solvent vapors and combustion products, while the oven walls and roof should be suitably insulated to keep the heat where it belongs, since there are more efficient ways available to heat the building.

It has been said, with some degree of truth, that the average purchaser knows less about ovens than he does about any other equipment he orders, which is all the more reason to install only a carefully designed system. Just any oven won't do, because not only is it necessary to bake properly, but to bake economically, with safety, and with provision for temperature reserve to keep up with the trend toward higher baking levels.

Nathaniel Hall

Multicolored Effects on Anodized Aluminum

By Dr. A. Jogarao, B. A. Shenoi and K. S. Indira, *Central Electrochemical Research Institute, Karaikudi, India*

WHEN aluminum is treated as an anode in an electrolyte such as sulfuric acid, the oxygen evolved at the anode reacts with the metal to form an oxide which offers resistance to the flow of current. However, simultaneously with the formation of the oxide film, the outer layers of the film are liable to chemical dissolution, causing the film to be somewhat porous. It is necessary that the anodizing conditions be adjusted in such a way as to have the rate of formation of the aluminum oxide exceed the rate of dissolution, which determines the maximum thickness of oxide attainable under normal conditions of anodizing.

When electrolytes like sulfuric acid, chromic acid, oxalic acid, etc. are used, the films formed on aluminum during electrolysis are adherent and sparingly soluble, in which case their growth to a required thickness becomes possible only provided the temperature is under control. The oxide thus obtained has many important and significant properties, one of the most interesting being the porosity and ability to adsorb substances that impart color to the coatings.

It is generally believed that the aluminum oxide present on the surface after anodizing consists of three layers; the first, which is closest to the metal, is compact, hard, and adherent to the basis metal; the second is porous and sufficiently thick; and the third is a superficial 'bloom' which can be avoided by controlling the anodizing conditions, particularly temperature.

Suitability of Films for Dyeing

If decorative effect is the ultimate object of anodizing processes, certain important considerations must be taken into account. In assessing the suitability of any one treatment for subsequent dyeing, the main characteristics are the initial color of the film, its thickness, and its absorptive power.

Since films formed by the chromic acid process are opaque, ranging in color from a light gray, clear bright shades cannot be obtained by dyeing. But, by modifying the chromic acid process, it is possible to get opaque films which on coloring give enamel-like finishes. In the case of oxalic acid anodizing, the films are semi-transparent and, hence, the resultant shades are affected by the color of the film. The nature and chemical composition of the aluminum are important and determine the color as well as other properties of the anodic films formed. Completely transparent and colorless films are formed by the sulfuric acid process and are ideal for dyeing if the correct type of aluminum is chosen. Super-purity aluminum and its alloys are best for this.

Optimum Anodizing Conditions

The grain size, porosity, and thickness of the oxide film can be varied by varying the anodizing conditions. The possibility of dyeing the film in different colors depends mainly upon the capacity of the film to take the dye. The intensity of the color, in turn, depends upon the thickness and structure of the oxide film, and on the composition and temperature of the dye bath. However, it is found that, under identical conditions of dyeing, the intensity of the color increases with increasing thickness and porosity of the film.

The aim of anodizing before coloring is to produce thick and porous, but not loose or powdery, coatings, as the color intensity depends upon the amount of dye taken up by the coating. The strength of the electrolyte and its operating temperature have an important influence on the response of the anodic film to dyeing, as well as on the ultimate performance of the coating. Sulfuric acid electrolyte maintained at 22°C. is strongly recommended for anodizing purposes, since it readily gives coatings with uniform characteristics and of reasonable hardness to withstand handling.

Optimum conditions:

Sulfuric acid concentration	15% W/V.
Current density	18-22 amp./ft.^{2}
Bath voltage	12-18
Temperature	22 ± 1°C.

For superpurity aluminum lower current densities are recommended.

The anodized aluminum is washed in water several times to completely free it from traces of acid. Rinsing prior to coloring is important in obtaining consistent shade and uniformity. Dyeing should not be postponed too long, as prolonged storage will decrease the adsorptive power of the coating.

Coloring With Organic Dyes

The colored effects can be obtained on anodized aluminum by direct contact with the dyestuff solution, in which case the article is immersed in an organic dye bath, or by precipitating the coloring medium by

double decomposition methods, as in inorganic pigmentation.

The color obtained is dependent upon the aluminum oxide film and the dye adsorbed. The important factors which influence the coloring processes are (a) good rinsing, (b) the type of dyestuff and its dispersion, (c) its concentration, (d) temperature of the dye bath, (e) pH of the dye solution, (f) time of treatment, and (g) nature of the oxide film formed.

The best effects are obtained by most of the organic acidic dyes. The dyestuffs employed must be adsorbed deep down into the coating and they must, of course, be lightfast, though lightfastness obtained will depend also upon the aluminum alloys used, the method of production of the coating, and the sealing operation subsequent to dyeing. The concentration of the dyestuff depends upon the depth of shade desired. For single coloring, a suitable temperature of the dye bath is 70-80°C., where partial sealing also takes place and, hence, no bleeding of the dyes occurs during the sealing treatment. Since the adsorption depends largely on the pH of the dye solution, the pH should be checked periodically and kept within the range for which the dye gives the best shade.

It is important to ensure that the dyestuff is in complete solution, otherwise spotty coloring will be the result. The dyestuff is weighed and made into a paste with cold, distilled or deionized water and then dissolved by the addition of hot water. After immersion in the bath for the required length of time, the articles are removed, washed, and finally sealed in boiling water or steam, or in nickel or cobalt acetate solution.

The best results appear to be obtained with dyestuffs which are capable of forming lakes or coordination complexes with aluminum oxide. Some of the manufacturers have special dyestuffs known as aluminum dyes.

Inorganic Pigmentation

Anodic oxide films on aluminum may also be colored by precipitating an insoluble inorganic salt inside the pores of the film by double decomposition methods. In the organic coloring process, the adsorption of the dye takes place in the film itself, but in this process in addition to the adsorption of the compounds, chemical reaction also takes place, and the coloring effect is brought about as a result of chemical reaction.

For inorganic pigmentation process, the film of Al_2O_3 should be much thicker than those meant for organic dyeing. So the conditions of anodizing are slightly altered i.e. the c.d. = 24 amp./ft.^{2} and the time of anodizing 70-80 minutes. The anodized parts are immersed first in a solution of one compound, washed in water and then immersed in a solution of another compound. In both solutions the parts are kept for 5-10 minutes. The solutions are kept at room temperature. The following table shows some of the color finishes that can be obtained by this process. After the treatment the articles are sealed in boiling water for an hour.

For outdoor exposure, blue and black are desirable, the other colors obtained by the above methods are not quite satisfactory as regards the lightfastness properties.

IMITATION BRASS:

Brass or gold color can be obtained by dipping the anodized aluminum in a solution of ferric ammonium oxalate (2 g./l.) at 65°C., the time of immersion depending upon the depth of shade required. The pH is maintained at 5.5-6.3. The tone can be further strengthened by subsequently dipping the object in a 0.1% solution of gallic acid. The color is the result of ferric hydroxide deposited within the pores of the oxide layer, lightfast and, hence, good for outdoor exposure.

If the pH falls below 5.5 satisfactory results can still be obtained but the dyeing time will have to be extended.

BRONZE SHADES:

These are produced by alternate immersion in 40 g./l. solutions of cobalt acetate and of potassium permanganate, with short rinses between each dip. The depth of shade is dependent upon the number of immersions in each bath for any given concentration and temperature.

The temperature of the bath is kept at 50 ± 2°C. and the number of immersions is 2-5 in each bath.

For pale bronze shades, three immersions will be adequate and this color has proved more popular.

Multicolor Processes

PHOTOGRAPHIC PROCESSES:

Various multicolor patterns and designs in anodic coatings of aluminum can be obtained by the photographic processes. These processes consists of depositing the light-sensitive materials into the pores of the anodic film. The light-sensitive materials are introduced into the film as is done in the usual dyeing processes. The work may be either immersed in a solution of the photosensitive material as in 'blueprint process' or by precipitation methods where the photosensitive material is insoluble, as in the case of 'silver halide process'. Photographic printing methods find extensive use in making exact reproductions, e.g., slide rules, dials of all kinds, charts, labels, name plates, sign boards, etc.

The best known processes for multicolor effects are

	Color	*Solution I*	*Solution II*	*Pigment formed*
1.	Blue	15% potassium ferrocyanide	10% ferric chloride	Prussian blue
2.	Black	20% cobalt acetate	12% ammonium sulfide	cobalt sulphide
3.	Orange	20% potassium dichromate	10% lead acetate	lead chromate
4.	Brown	20% potassium ferrocyanide	15% copper sulfate	copper ferrocyanide
5.	White	15% barium acetate	15% sodium sulfate	barium sulfate

the "resist process" and the "direct printing process."

RESIST PROCESSES:

In the older process, which is uneconomical and time consuming, the aluminum article is anodized and colored in one shade (say yellow). Whatever portion is required in yellow is masked and the exposed aluminum oxide is dissolved out with dilute sodium hydroxide solution. When all the oxide is dissolved out, the plate is reanodized and again colored (say with red), following which the portion to be required in red is masked, followed by stripping and reanodizing to give a third color if desired. There is, of course, a limit to the number of colors which can be applied in practice. Secondly, the process is laborious and, thirdly, it is costly from the view point of energy consumption.

Multicolored effects can be achieved by the following two methods of which the latter has proved more useful.

Superimposition Techniques

The aluminum (which is anodized under the optimum set of conditions) is dipped in color I (noting the usual precautions) and, after drying, the resist is applied in the portions where that color is to be retained. The plate is then immersed in a second dye, during which treatment the uncovered portions will adsorb the second color. Then the resist is removed using a suitable solvent. Thus, a two color effect is obtained. The procedure can be repeated until 3 or 4 colors are obtained. This method suffers from one main drawback — the correct shade cannot always be obtained, e.g. the superimposition of blue over yellow gives green tinge and not blue. In this process also, the order of procedure is from a light color to a dark one, i.e., in the ascending order of intensity.

Bleaching Process

The difficulties encountered in the superimposition processes are overcome in the bleaching process to a large extent. The anodized plate is immersed in a dye solution and, after drying, the resist is applied to the portions which are to remain in color I. The next step is to remove color I from the remaining portions by careful bleaching. The plate is next dipped in color II. Again the resist is applied wherever color II is to be maintained and the color is bleached from the remainder as before. By repeating the above processes a number of times, many colors are obtainable, provided suitable precautions are taken. The following is the sequence of operation for design in yellow on a blue background.

1. Anodize and dye yellow in cold.
2. Rinse with distilled water and dry.
3. Apply resist on portions that are to remain yellow.
4. Bleach exposed areas by dipping in 10% nitric acid.
5. Dye in blue.
6. Seal and remove resist.

Of the many resists suitable for multicolor work, lithographic ink and chlorinated rubber paint have been found superior to asphalt, shellac, or collodion solution.

For bleaching purposes, the following solutions are also suitable:

1. Slightly acidic solution of bleaching powder
2. 1% solution of sodium hypochlorite
3. Dilute solution of sodium hydroxide

No. 3 affects not only the oxide film but, in due course, will affect the basis metal. The others keep the aluminum oxide unsealed for a longer time. However, some dyes cannot be removed by nitric acid, whereas a solution of sodium hypochlorite may be suitable.

The following precautions are to be noted for successful multicoloring processes.

1. As regards the order of colors, the light colors are applied first. Order is yellow, red, blue, green, violet, indigo, and finally black.
2. Temperature of the dye bath should be raised in steps, e.g., if the temperature of the first dye bath is 30°C., that for the next one is 35°C. and so on.
3. At no time should the temperature of the dye bath exceed 70°C., except in the case of the last color, because the film gets sealed, and further coloring becomes rather difficult.
4. After coloring, rinsing, etc., the anodized films should be allowed to dry at room temperature. If higher temperatures are used the anodic film gets sealed and further processing becomes impossible.
5. To get the correct shade, adjustment of pH should be made with acetic acid since the adsorption of the dye depends largely upon the pH. It is to be kept within 2.4-5.

Relief Designs

After anodizing, the aluminum is washed and dried. The necessary design is drawn on the plate with a resist (either with chlorinated rubber paint or with lithographic ink). Then the plate is immersed in a suitable liquid which will dissolve out only the exposed aluminum oxide. The resist is removed with a suitable solvent. The film is finally sealed and buffed.

The film of aluminum oxide can be dissolved either in hot acetic acid solution or in a solution containing 10% chromic acid and 8% phosphoric acid at 100°C., the latter being preferred.

A combination of multicolor effects with relief design can be produced successfully. The article is dipped in an organic dye solution, preferably in light blue or in yellow, and the design is drawn with a resist. The rest of the dye is removed by treating it in 10% nitric acid, and the part again dyed in another color and the design is drawn. The rest of the color is removed and the above treatment can be repeated till 4 or 5 colors are obtained. Finally, the plate is dipped in the desmudging solution which usually does not attack the resist, but dissolves out the aluminum oxide remaining outside the resist. The resist is finally removed and the designs which are in different colors are obtained in relief. The film is finally sealed, and buffed.

Mottled Effects

This process has been described in detail by G. O. Taylor, where dyestuff solutions are applied to dry, unsealed, anodic coatings; concentrated dye solutions (2%) are used, which can be thickened by the addi-

tion of glycerine or of 20% of the following mixture:

Indian corn starch	75 g./l.
Tapioca starch	25 "
Gum Tragacanth (8%)	225 "

Mottled effects can be produced by using a sponge. The anodized plate is first dyed in a light shade and then given a contrasty color by means of a sponge which is dipped in the thickened solution of the organic dye and allowed to dry in air. A concentrated solution of another dye, thickened suitably, is applied by means of a sponge on the other portions. The portions which are already covered will not adsorb the second dye because the starch itself acts as a partial resist. The procedure is repeated at room temperature until one obtains the desired colors. After drying, the metal is steamed for 15 minutes for sealing, rinsed and dried. Sealing in boiling water is not advisable since a mingling of colors may take place.

Sprayed Effects

Graduated color effects merging into one another can be obtained by applying a concentrated solution of the dyestuff (as in the previous case), with a spray gun held above the anodized article. The same effect can also be achieved by means of brushes held at different angles. The articles (after drying) are steamed at 100°C. to fix the dye. The presence of starch in an anodic pore, however small the amount, is harmful from the corrosion aspect, and the following solution is found to be better for spraying effects:

Dye	8 g.
Glycerine	32 cc.
Water	60 cc.
Acetic acid	few drops

This composition for spraying purposes has certain advantages. The glycerine, being hygroscopic, retains the dye in wet condition for a longer time. Acetic acid being in the composition, the dye gives the correct shade. To improve the appearance of anodized parts they may be buffed after steam sealing, using soft wheels to increase the metallic luster and gloss.

Silk Screen Printing

In this process the design can be printed with a suitable ink or dye, using a silk stencil or masking by silk screen technique and subsequently dyeing.

The resist is applied in the silk screen and squeegied on the anodized aluminum plate which has first been given a light color, such as yellow. The rest of the color is removed, using a bleaching solution, and then the plate is given a second color. Again, the resist in the required design is applied as before, and the process is repeated until the required effects are obtained.

Silk screening saves time in marking dials and name plates. The screens are used mainly for such jobs as printing small dials, computers, nameplates, etc.

Printing Processes

DIRECT PRINTING:

Designs can be printed on anodized aluminum by means of a rubber plate using an aqueous solution of a dye stuff to which 30% of glycerine has been added. After direct printing with dyes, the plate is not washed but is steam sealed. Though name plates and dials of all kinds can be produced by the photographic methods they are relatively more costly.

OFFSET PRINTING:

Printing on anodized aluminum can also be carried out by applying the resist through an offset printing machine. The process is a variation of lithography in the sense that the printing ink is transferred to the object by means of surface plates. The transfer of the reverse ink from the matrix to the anodized aluminum is accomplished with the aid of a rubber roller.

Conclusions

Anodizing, followed by dyeing, provides an effective method of finishing aluminum and its alloys for decorative purposes. The use of aluminum and its alloys for production of a wide range of extensively-used articles, with surface finish imitating gold or brass, and for instrument parts, will make it possible to effect considerable savings of scarce and costly metals and alloys. In conjunction with special mechanical treatment of the surface, anodizing and dyeing produce attractive surface finishes which can be used to imitate in appearance certain types of wood or stone. Post-war building trends have been increasingly towards the curtain wall type of construction and, in this field, aluminum has many advantages over more traditional materials, particularly due to its lightfastness and ease of fabrication and erection. Thus, the use of anodized and dyed aluminum for architectural applications is getting well established.

The outstanding application of the multicolored process on anodized aluminum is in making labels, scales, slide rules, and other flat metal objects. A considerable number of designs can be produced with natural color in a colored background by the silk screen method. Apart from purely decorative purposes, exact reproductions can be made by direct printing using a rubber sterio or litho printing.

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Surface Area and Weight of Commercial, Hexagon Head Screws

By George Clayton Field, *Brookfield, Wis.*

THE value of charts such as the ones shown here, is realized by their utility in determining load measurements with the least effort. When it is necessary to estimate loads for a variety of parts of every shape and size, within the limits of barrel plating, every short cut is welcome. While it is possible to estimate loads for hexagon screws from some charts previously published by measuring the elements separately, it will be found much handier to have some of the elements combined, as in the hexagon screw chart.

Charts of a similar construction for use with round head screws were published in the May 1960 issue of METAL FINISHING. Due to the fact that hexagon screws usually run in heavier sizes, the weight, in relation to the surface area, increases proportionately as the sizes increase. For this reason an additional scale was constructed, so that there is one for weight load limits and one for surface area limits.

How To Use the Charts

For example, we will suppose that a standard hexagon head screw ½″-13 x 2½″ long is to be measured for plating in regular horizontal type barrels. Those who have done considerable estimating of these heavier screws have learned that they should be limited by weight. To determine the weight per 1000 pieces see the right hand side of the chart and follow the ½″-13 line that slants downward to the right. Find where it intersects the 2½″ perpendicular line, taken from the length from the bottom of the chart (Length for Weight), then follow the horizontal line to the right and read 154 lbs. at line "Y". This is 154 lbs. per 1000 pieces. Now if the load limit for weight limit of the horizontal barrel is 175 lbs., then lay a straightedge from the point of 154 lbs. on line "Y" to the point of 175 lbs. on line "D" and read on the diagonal line (D), 1140 pieces per load.

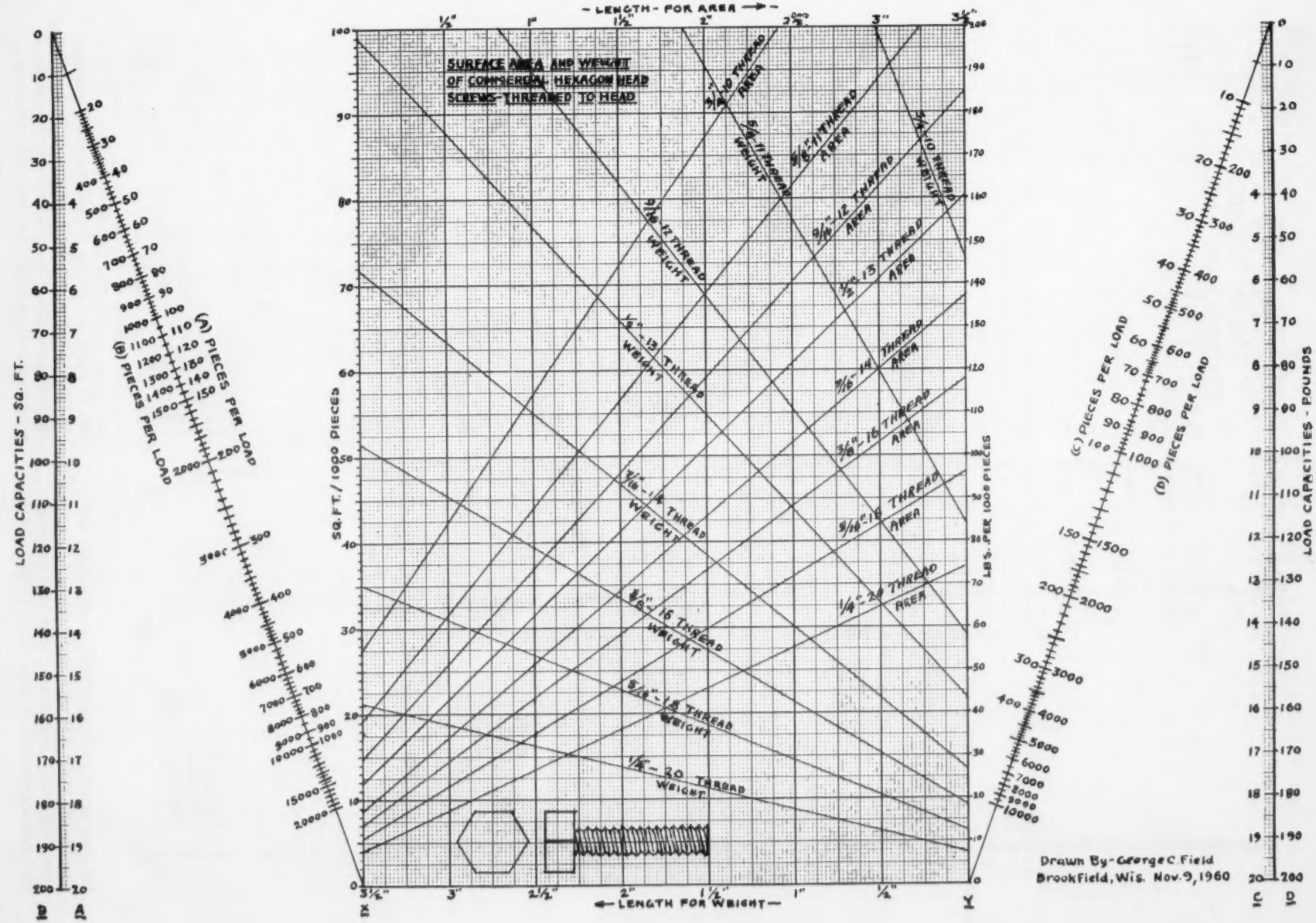
Should the screw have a plain portion, then determine the weight of the head and threaded portion, as the first step and then refer to the chart in Figure 2. Use that line indicated as "Weight of Plain Portion" (Z) and add it to the above, then proceed to find the proper load. Read the legend on Figure 2 for directions on reading the chart.

If it is required to determine the loads for automatic plating, it will be necessary to find both weight and area. Using the same screw, we have a weight of 154 lbs. per 1000 pieces. For area, find where the ½″-13 diagonal line slants downward to the left, intersects the perpendicular line at 2½″ (Length for Area) indicated at the top of the chart. Read at the horizontal line directly to the left on line "X" 61 sq.ft. per 1000 pieces.

Now it is necessary to know what the barrel load limit is. Refer to the April 1960 issue of METAL FINISHING for a suggested Selecting Guide table for a means of barrel selection. Also read general instructions for using the proper barrel. In this instance it should be noted that we are limiting the plating thickness to 0.00025″ because of the threaded portion. The Selecting Guide suggests using 40 sq.ft. for barrels with ⅜″ holes, 25 sq.ft. for barrels with ¼″ holes, and 15 sq.ft. for barrels with ⅛″ holes.

To use the chart shown in Figure 1 for load determination, lay the straight edge across from 61 sq.ft. on line "X" to 40 sq.ft. on line "B" and read 650 pieces per load. Now we want to see how much the load of 650 pieces weighs. Lay the straight edge across from the point of 154 lbs.-weight per 1000 pieces, to the point of 650 (D) pieces per load, on the diagonal line at the right and see 100 lbs. This is probably too much weight for the barrel if the limit is 50 lbs. as shown in the guide table. For this reason we will have to select a barrel with smaller holes, so we will try the one with ⅛″ holes. Set the straight edge on the 61 sq.ft. point on line "X" again and swing the other end down to 15 sq.ft. for a ⅛″ hole size barrel and read at (D) pieces per load, 245. Now, with this new figure, lay the straight edge across from 154 lbs. per 1000 pieces on line "Y" across the point at 245 pieces on the diagonal line and read 37 lbs. for the load on line "D". This is well within the 50 lb. weight limit and may be used without damage to this type of barrel. If the equipment has other limits, one only need make a Selecting Guide of one's own and use the charts accordingly.

The Chart shown in Fig. 2 can be used for studs and pins to determine area and weight. To use it, read the legend on the chart. The May 1960 issue of METAL FINISHING showed such a chart, but the scope


SURFACE AREA AND WEIGHT
OF COMMERCIAL HEXAGON HEAD
SCREWS-THREADED TO HEAD
LENGTH - FOR AREA
LENGTH FOR WEIGHT
SQ. FT. / 1000 PIECES
LBS. PER 1000 PIECES
LOAD CAPACITIES - SQ. FT.
LOAD CAPACITIES - POUNDS
(A) PIECES PER LOAD
(B) PIECES PER LOAD
(C) PIECES PER LOAD
(D) PIECES PER LOAD
3/8"-11 THREAD AREA
3/8"-11 THREAD WEIGHT
5/16"-12 THREAD AREA
5/16"-12 THREAD WEIGHT
1/2"-13 THREAD AREA
1/2"-13 THREAD WEIGHT
7/16"-14 THREAD AREA
7/16"-14 THREAD WEIGHT
3/8"-16 THREAD AREA
3/8"-16 THREAD WEIGHT
5/16"-18 THREAD AREA
5/16"-18 THREAD WEIGHT
1/4"-20 THREAD AREA
1/4"-20 THREAD WEIGHT
Drawn By-George C. Field
Brookfield, Wis. Nov. 9, 1960

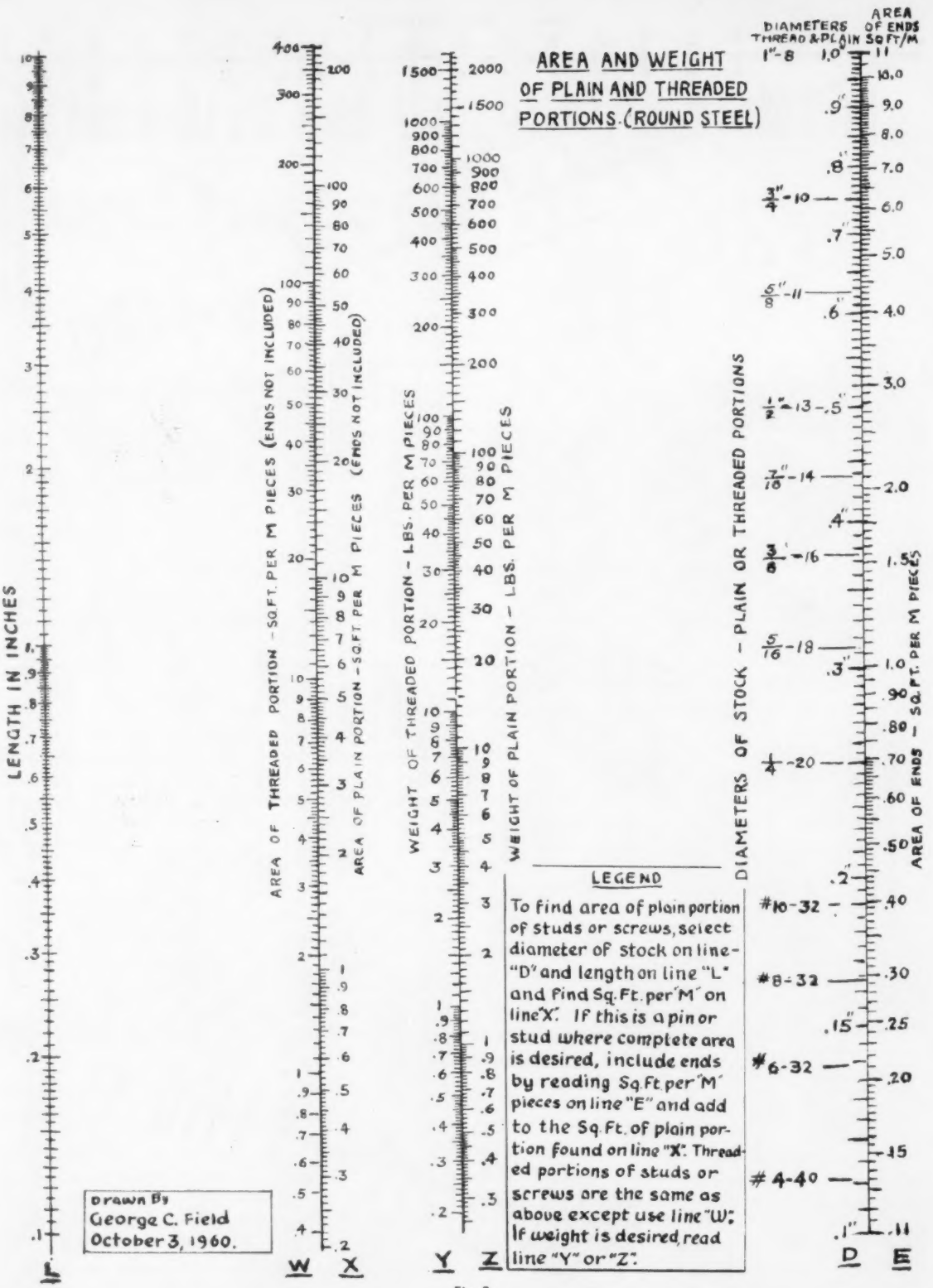


Fig. 2

has been increased for use with hexagon head screws and also its utility has been increased by adding the area of the ends at the right of each diameter. It is possible to calculate studs and pins up to 1" diameter. As with all charts and graphs, the results are approximate but, for all practical purpose such as estimating plating loads, it is possible to be sufficiently accurate so as to be of great help as a short cut and ready reckoner.

Paint as an Engineering Material for Plastic Business Machine Parts

By T. E. Hayden, *Bee Chemical Co., Lansing, Ill.*

PLASTIC paints are truly a class of engineering materials. Utilized for decorative, functional or economic purposes, their value is becoming more pronounced as their advantages are known. To adequately perform his job, the design engineer specifying finished plastic component parts requires knowledge of the effect of paint upon the durability of the plastic part as well as the physical properties of the paint itself. To serve as a basic guide to him we shall examine finished part durability from two aspects: (1) physical properties of paints and (2) coating considerations which are of most importance to the durability of the decorated part.

Because of the many types of paints and plastics, the scope of this paper does not allow concise studies which could be presented detailing each of the following summaries, so by necessity, we must speak in broad terms realizing there are exceptions.

I. General Effect of Paint Upon Thermoplastics

Mechanical

Generally paint-film hardness and extensibility are inversely proportional and, since most applications demand hard, mar-resistant coatings that adhere well, extensibility is usually sacrificed. A decrease in impact strength of the painted part may result, especially if the part is bent or struck in such a way as to place the paint film under tension rather than compression. Such is the case if the impact force is applied opposite to the coated side, thereby stretching the paint more than the plastic. In theory, because the paint film adheres and does not "pop off" the plastic, the paint fractures first and the stress concentration point is carried through the plastic. The same force applied to the coated side, placing the paint film under compression, would not result in lowered impact resistance. This can be demonstrated with a flat piece of plastic, painted on one side. Bending the part first so that the paint film is the inside diameter, and then so as to be the outside diameter, causes premature cracking of the plastic. This is a simple illustration and, although the problem can become more complex with intracately designed parts, most injection molded items are adequately strength-designed so impact problems are few. As can be seen, the danger of under-designing is less with first surface decorated parts. A recent study dealing with acrylic and polyester resins pointed out: —

"An evaluation of their intrinsic properties shows clearly that, in many applications where die castings have traditionally been used, such plastics can meet the physical requirements when proper design principles are followed. Furthermore, it has been shown that in most cases parts can be designed to give adequate strength without a prohibitive increase in volume over that of a metal part performing the same function. The specific gravities of these plastics are much lower than those of die casting alloys so that the plastics parts even at increased thicknesses are still lighter in weight than the metal ones."[1]

In the above quotation, the reference is to resins which are to be molded for automotive applications and decorated by common spray or vacuum metalizing methods.

In addition to the effect of dried paint films upon impact and flexural strength, a more frequent problem is crazing which may occur shortly after the paint is applied. Craze points, caused by the presence of internal strains that exceed the strength of the plastic are caused by:

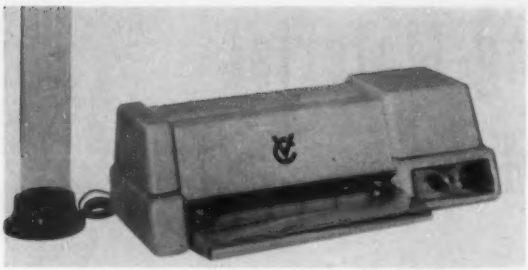
1. The too rapid cooling of a hot plastic.
2. Mechanical strain resulting from excessive mechanical forces.
3. Absorption of paint thinners which are non-solvents for the plastic.

Of this, only the first two can cause crazing alone. To craze upon contact with paint thinners the parts must already be strained. For example, parts already strained just short of crazing by temperature shock require less force to craze, and the absorption of non-solvent thinners is sufficient to accomplish this end. The solution may be to mold with longer cycles and with warmer cavities, to anneal to remove strain, or to adjust paint solvents.

The impact strength of a finished part remains a function of the type of plastic, supporting design, wall thickness, molding conditions, efficiency of annealing operations and subsequent finishing operations. Thermoplastic items such as shoe heels, which undergo tremendous working forces, were not greatly impaired by lacquering until the trend to thin, high-style heels forced the use of steel reinforcing dowels even in unpainted heels. Thermoplastic football helmets, another example of painted parts which take much abuse, are not supported by metal, but are intrinsically strength-designed.

Chemical

The chemical properties of many plastics may be made better by the application of a paint. Solvent resistant clear or pigmented paints may be applied to plastics to protect them from the deleterious effects of



(Courtesy Visual Communication Corp., Old Sayebrook, Conn.)

Fig. 1. Coated plastic covered business machine.

concentrated acids, solvent etch, perspiration or staining. Such coatings are used for decorating or protecting battery cases, pen barrels, hospital trays, liquor bottle caps and business machine housings.

Because of the economical advantages of painting virgin white, vacuum-formed housings rather than molding them in small lots of special colors, one business machine manufacturer required a paint to resist photographic solutions, containing 5% sodium hydroxide, for short times should the solution be spilled upon the machine. A chemical resistant top coat over the color coat would add too much cost; therefore, the color coat was designed so the solution, if removed within 15 minutes, would not harm the paint. A puddle of solution allowed to remain longer will cause only a very slight color change. Figure 1 shows a typical part displaying this coating.

Care must be taken when selecting coatings to meet the requirement of a part to insure all the operating properties are met. This requires thorough knowledge of the function of the part. If the painted surface will come in contact with plasticized polyvinyl chloride dust covers or adjacent parts molded from cellulose acetate, the paint must resist harmful effects resulting from plasticizer migration. Since plasticizers are extremely slow drying solvents, they may migrate into the paint film, actually redissolve it, and cause the paint to become tacky. Special coatings resist the harmful effects of plasticizer migration.

Electrical Properties

Data of the effect of paint upon plastic dielectric strength or other electrical properties is usually not required except in rare instances. More frequently asked is the question of how to electrostatically paint non-conductors such as plastics. This may be a serious production problem to business machine firms who consider changing from metal to plastic parts. The part must be made a conductor, hence there are two basic answers. An electrically conductive paint may be applied prior to electrostatically applying the final color coat. The alternate and most desirable method is to mix conductive media, usually carbon, with the plastic before molding, to eliminate two coats of paint. Since the resulting color is black, second surface decoration is precluded and in addition ease of molding may be somewhat hampered. Incidentally, vacuum metalizing top coats may be applied electrostatically to plastics since the vacuum deposited aluminum is sufficiently conductive.

One company compared physical properties of reinforced styrene to the same formulation with sufficient carbon added to allow electrostatic spraying.[2]

Property	*Filled Styrene*	*Black (EC) Filled Styrene*
Tensile strength @ 73°F., psi.	14,000	11,000
Izod Impact Strength @ 73°F., ft. lbs./in.	2.9	1.7

The comparison demonstrates that conductive fillers can detract from the normal strength of the plastic, although with proper design adequate part strength can be obtained.

The electrically conductive coatings just mentioned may have use in business machines. They are presently used on the reverse side of TV bezels which are first surface decorated with metallic paints such as golds. The individual metallic particles of the gold charged by high voltage of color sets, act as capacitors and are capable of giving a jolt to someone touching the bezel. The conductive coating, applied between the high voltage source and the metallic paint and grounded, prevents the accumulation of the charge.

II. Physical Properties of Paints for Thermoplastics

Physical properties of the paints themselves can vary so widely that a complete description is difficult; therefore, we shall discuss those properties which are commonplace and generally accepted. In some instances, special properties will be mentioned. The knowledge of performance of paint films will most

TABLE I

Typical Hardness and Humidity Properties of Paints for Thermoplastics

Type of Plastic	*Pigmented Spray and Screen Paints*		*Vacuum Metalizing Systems*	
	Hardness	*Humidity Hours*	*Hardness*	*Humidity Hours*
ABS (Injection Molded)	2H-3H	1000	2H-3H	500
Acetate	*	1000	*	24
Acrylic	2H-3H	1000	2H-3H	1000
Polyolefin	*	500	*	100
Polystyrene	2H-3H	1000	H	170-500
Rigid Vinyl	2H-3H	1000	H	170-500
Flex. Vinyl	*	100	N/A	N/A

*These plastics are considered to have soft surfaces; hence paint hardness is more a function of the hardness of the specific plastic substrate.

The hardness tests were conducted using Venus drafting pencils, with a sharp conical edge ($\frac{1}{64}$" x $\frac{1}{32}$") held at 45° angle. Hardness indicates that pencil will not cut the paint film before the lead crumbles.

Humidity tests conducted at 110°F., 100% relative humidity. The hours indicate increments passed with no softening, blistering or loss of adhesion of the film after a 15 minute air dry recovery period. All tests stopped after 1000 hours.

certainly aid the design engineer in the selection of the best materials to do the job.

ADHESION

Contrary to common opinion, properly formulated plastic paints do not adhere by virtue of solvent attack or etch. If they did, second surface (reverse side) decoration could not be accomplished without visible objectionable crazing or etching, which in extreme cases causes the plastic surface to appear like frosted glass. Even though some plastics may tend to absorb solvents, adhesion is not dependent upon this. Adhesion to rough surfaces may be mechanical, but much more important is "specific adhesion" which depends upon the polarity of the part and the plastic — to bond through van der Waal's forces — or through primary valences. Simply this means "natural" adhesion. The phenomenon of adhesion explains the necessity to oxidize the surface of polyolefins, which are non-polar, by pre-treating. Because polyolefins are inert, even strong solvents cannot be used for adhesion through etching.

Although pencil tests and more complex machine tests can be used to measure adhesion, the Scotch tape test over a cross-hatched area is generally recognized as the industry standard. Coatings are considered adequate if they are capable of resisting rapid withdrawals of the firmly applied tape.

Many factors can adversely influence adhesion, but the most notorious offender is mold release agents, which by nature are designed to be "non-stickers." Many molder-finishers try not to use mold lubricants on parts to be subsequently decorated; however, they can do so only if the part and the mold are designed with ease and speed of ejection in mind. Excessive amounts of mold release agents used for fast mold cycles has cost the plastic industry thousands of dollars in reject parts.

Hardness of a Paint Film

A hard film with a low coefficient of friction to add abrasion resistance is usually desired. Although a paint may be considered good in itself, one must consider the hardness of the plastic to which it is applied as well as the effect of pigmentation. A given paint applied to acrylic may be exceptionally hard, but applied to a soft-flow butyrate may appear to have lost hardness unless it is remembered that thin paint films are not self-supporting and must have firm backing to display their true characteristics. Generally, high gloss colors will have more hardness and abrasion resistance than semi-gloss or flat colors.

Table I illustrates the relative hardness of lacquers for various types of plastics, including top coats for vacuum metalizing. The data given are for coatings in normal use and do not necessarily indicate the highest or lowest values obtainable. The table shows 2H-3H pencil hardness for lacquer for polystyrene. Although generally true, this indication would be quite false for expanded styrene because of the extremely soft surface hardness of the plastic itself.

Abrasion Resistance of Paint Films

Most quality air drying paints, including vacuum metalizing top coats have excellent wearability characteristics and will pass most stringent requirements. Described below is a wear test for such coatings:

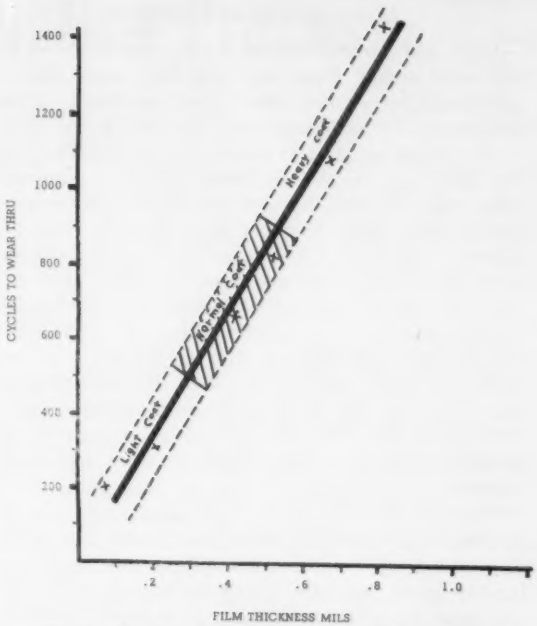


Fig. 2. Abrasion resistance of paints for ABS tripolymers.

A two inch wide band of 1.95 cotton drill is loaded with a five pound weight and reciprocated across the surface of the part at 12 cycles per minute. The device travels across the part for a distance of 8 inches. The parts must withstand 10,000 cycles without a breakthrough of the coating.

An example involves the use of air drying paints to decorate vacuum formed ABS tripolymers. Such plastics are used for luggage pieces and are becoming popular for small business machine items. One unit, a typewriter carrying case, was originally sprayed with a flat clear paint to maintain uniform gloss. By switching to a colored, flat paint, random color plastic is now used which affords economy.

Figure 2 displays abrasion data for varying film thicknesses of a typical paint for ABS plastics. The test was conducted using a Taber Abraser with CS-17 wheels and a 1000 gram load. Specimens were coated with a gloss black painted on smooth tripolymer in the mil thicknesses shown.

Table II compares the abrasion resistance of pigmented metallic spray paints for plastics to a like color automotive exterior body lacquer. This test is indicative of the high quality coatings now being used to decorate plastics.

TABLE II

Results of Taber Abraser Test

Material	*Cycles/mil of Film Abrasion*	*Per cent Increase*
Automotive Paint	1850	—
Normal Pigmented Plastic Paint	1925	4%
Plastic Paint — Pigment underloaded to equivalent of auto paint	2425	31%

Light and Heat Stability

Light and heat stability of a paint are functions of the basic resins, fillers and pigments used. Unless specifically forewarned, most paint manufacturers do not necessarily incorporate only heat stable pigments in air drying lacquers. Virtually the same holds true for light stable — that is, fade resistant — pigments with one exception. Seldom are quality paints pigmented with dyes; generally quite durable "indoor" pigments are used. For outdoor applications such as signs, special pigments are used. Normally "indoor" pigments will withstand 10-100 hours under accelerated conditions before objectionally fading. As a very general statement masstone, or deep colors, are more resistant to objectionable fading than tint tones or pastels. When required, pastels can be made satisfactory for outdoor use, although it makes color matching more difficult and often results in more expensive paints.

The heat stability of vacuum metalizing coatings is quite important since base costs, with low heat-distortion temperatures, can "shift or flow" with an increase in temperature causing the vacuum deposited aluminum to iridesce or take on a milky rainbow effect. Base coats with higher heat-distortion temperatures are used for plastics such as acrylic and injection molded ABS, which find common use for interior automotive or other applications where operating temperatures are considerably above room temperature. Heat tests range from 7 days exposure at 140°F. to more elaborate requirements such as 24 hours at 175°F., followed by room cooling for several hours and then 24 hours at —20°F. Metalized parts are acceptable if they display no iridescence, stickiness, blistering or loss of adhesion of the aluminum to the base coat after testing. In all cases these tests are designed with the actual operating conditions of the parts in mind.

Humidity and Salt Spray Resistance

Quality spray coatings can be expected to withstand 1,000 hours in the humidity cabinet at 110°F., 100% relative humidity with no softening, blistering or adhesion loss. Table I demonstrates normal humidity resistance, in hours, for spray paints and vacuum metalizing systems for thermoplastics.

Salt spray tests are used to determine relative abilities of coatings to protect metals from corroding, and since plastics do not corrode, tests of most finishes on plastic parts are really nothing more than humidity tests. The paint films per se, with the exception of those containing metallic powders, are uneffected by salt spray. Metallic powders can objectionably corrode when exposed to salt spray.

Vacuum metalizing coatings can be radically effected by salt spray, since the thin aluminum can quickly and almost completely corrode and become a white metallic salt. Proper design has a great deal to do with the durability of the part, as does the durability of the base coats and top coats. For greater durability avoid extending the vacuum metalized aluminum all the way to an outside edge; but rather allow it to be "sandwiched" in by the base coat and top coat. Since paint films pull away from sharp corners and at best give minimum film thicknesses in these areas, the aluminum may not be adequately protected and, therefore, tends to deteriorate more rapidly from the effects of salt. Edge creep can quickly spread once started. Salt spray resistance is required for only the highest quality work such as on acrylic or injection molded ABS automotive parts or outboard motor emblems, etc. Generally about 40-50 hours salt spray is considered adequate.

Unusual Coatings

Coatings when applied to plastics are often thought of only for their decorative value and are not generally considered to upgrade the physical properties of the plastic substrata. In some cases, however, acrylic edge-lighted panels have been coated with an epoxy paint. The epoxy coated panel has very superior physical properties such that a 2 mil point radius needle loaded with 1000 grams and held at a 45° angle will not scratch through the coating when dragged across the surface. The coated panel is impervious to most organic solvents including ketones and esters, and as an added bonus has a considerably higher heat distortion point.

In effect the combination of a thermoplastic and a superior coating has become an entirely new material of construction. The field of functional coatings for plastics has only been touched and can be compared to the electroplating industry which is founded upon the concept of improving the durability of a substrate. Chrome plated steel is used because of the structural strength of steel and the surface durability of chrome plate. There are indications that plastics can be used in much the same manner.

Although the highest quality paints are usually preferred for business machine applications, it is sometimes advantageous to compromise on physical properties for economy or speed of production. Such is the case when special "dry wipe" paints are used to apply a color into indented letters of knobs or panels to accent these areas. Dry wipes, sprayed as normal paints, dry to a fine powder in ten minutes and are then wiped off the part with a dry cloth leaving paint only in the depression. This fast production process eliminates close-tolerance electroformed masks or messy and slower solvent wipes. Within a few hours, the paint in the letter welds into a solid mass, similar to normal paints, but is not quite as hard as conventional lacquers. Dry wipes can be removed by digging out with the thumbnail, hence are recommended for second surface work or only for properly designed first surface applications. Broad, shallow first surface indentations should be avoided; much preferred are recesses having a ratio of depth to width of 1½ to 1. Dry wipe coatings fit nicely into completely automatic machine production which applies and removes the paint. It is not uncommon for such units to deliver 800-1200 parts per hour.

References

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Eliminating the Gold Plating Process in Printed Circuit Boards

By Bernard Warshauer, *Project Engineer, Ampex Data Products Co., Redwood City, Calif.*

IN magnetic recording, printed circuitry is the nerve center of the equipment. New design and developments are constantly evolving, however, in the fabrication of the printed circuit board which is so widely used in the industry. The gold plating process, used to afford the utmost protection to copper conductor patterns, has been subjected to extensive investigation in an effort to determine whether board consumers and their customers are profiting by this highly-expensive process. Research into the development of possible substitutes for gold plating is well underway to find the most practical, economical, and advanced technique for producing an unplated board whose quality and reliability will equal or exceed the gold plated board.

In examining vendor-fabricated circuit boards, it was found that the gold plating process used on the boards was creating serious problems which affected their assembly. To determine the actual causes of defective gold plating, as well as the process' over-all value, it is necessary to evaluate the answers to the following questions:

1. How does the gold deposit become contaminated or defective?
2. What is the cost of the gold plating process?
3. What advantages are gained from gold plating?
4. Could another form of plating be substituted instead? Or, could all types of plating, with the exception of copper plating and gold plating of connector fingers, be eliminated?

Contamination — When Does It Occur?

CYANIDE CONTAMINATION:

Cyanide contamination can be described as a grainy compound appearing as spots on the surface of the deposit, particularly in cavities. This condition usually results from evaporation of the gold cyanide solution trapped in the pores of the plated surface. The cyanide complex, reacting chemically with the copper undercoat, forms a complex of copper cyanide, which appears as a yellowish-green discoloration, eventually changing to brown spots on the plated surface.

Because all components in the plating solution are interdependent, contamination problems, such as thin deposits of gold, gold flaking, delamination, and discoloration, can result if any one of the components is out of balance. The following examples illustrate how contamination occurs from disturbances in the bath:

a. *High Carbonate Content*: A high carbonate content can produce impurities which result in dark deposits in either high or low current density areas. This condition subsequently lowers cathode efficiency and throwing power because the free cyanide in the bath is too low; thus, foreign materials tend to co-deposit.

b. *Improper Current On Cathode*: If the proper current on the cathode is not maintained, the cyanide in the gold-cyanide separates and combines with the free cyanide in the solution. The resulting cyanide solution will then be deposited with the gold molecules on the surface to be plated, eating through the laminating material into the epoxy base, causing the copper to be lifted from the base.

c. *Effects of High Temperature*: Current density is increased in the solution when the temperature of the gold plating becomes too high. This, in turn, increases the rate of cyanide breakdown, and carbonate buildup occurs.

Some printed circuit vendors are using acid gold for plating to eliminate cyanide contamination. The use of such a process has some apparent drawbacks.

a. Plating time must be increased in order to obtain a deposit thickness of 80 microns of gold.
b. Acid gold plated circuits tend to cause difficulty in soldering processes.

Acid gold plating is a relatively new approach to the plating of printed circuits. It has the distinct advantage of eliminating cyanide contamination; however, the abovementioned points should not be overlooked when contemplating the use of acid gold.

LACK OF CLEANLINESS:

A board is exposed to contamination if it contains burrs, oils, or any agents that can weaken the bond between the basis material and the copper, or between the copper and the gold deposit. From the initial step in the board's fabrication process (shearing or blanking of the basis material), cleanliness is imperative. The cut and drilled blanks must be thoroughly scrubbed and rinsed to insure removal of any residue or lubricant resulting from the laminating process, the buffing process, or from handling. It is extremely important that the copper circuit side of the board be free from fingerprints, oils, silicones, or other agents

that might weaken the adhesion of the plating material. This is particularly true for boards with plated-thru holes, where oils and other substances in the holes make it difficult to bond the copper to the hole walls.

The degree to which a board is free of such contamination depends upon the thoroughness of cleaning before and after gold plating, the length of time the board remains in the cleaning bath, and the type of cleaning agents used. Chemically clean boards are those which are free from all impurities, not merely physically clean of oil and dirt. For example, the impurities in tap water, which is frequently used to rinse boards, can cause oxidation of the copper circuit and weaken the bond between the copper and gold deposit. Rinsing, therefore, should be done with de-ionized water. Similarly, the use of certain alkaline solutions in the cleaning baths can cause rapid delamination of the deposit. Steel wool and abrasive cleansers should never be used to clean copper circuits since the minute scratches these abrasive cleansing agents leave in the copper cannot be eliminated by plating.

Since most copper is porous to some degree, the plastic substrate can be squeezed through the pores of the copper during the pressing and curing of the lay-up in the laminating press. As a result, transparent specks of the unwettable, non-conductive plastic base are deposited on the copper. If the copper-clad laminate is not thoroughly cleaned prior to gold plating, the gold will build up around these deposits but fail to cover them. This, in turn, will create a gold plating pitted with pin holes. Through these microscopic holes, various chemicals used in the plating process can enter and attack the exposed plastic substrate and portions of the copper. For example, if the gold deposit is exposed directly to the ferric chloride etch solution, the ferric chloride will penetrate any opening in the deposit, dissolve the laminating bond, eat away the copper, and eventually cause delamination.

In an investigation of a rejected board that had been dip-soldered and completely assembled when one of the gold-plated connector fingers fell off, exposing the underlying copper surface, metallurgists found that portions of the copper had been eaten away. Further investigation proved that apparently no protection had been provided over the gold plating during etching, and the ferric chloride etching solution had penetrated pin holes and scratches in the deposit. It was easily assumed that the copper-clad laminate had not been cleaned properly, with the result that the ferric chloride etching solution was able to penetrate the pin holes in the gold, attack the bond, and undermine the copper.

The board was reworked but, in such a case, the most that can be done is to clean the copper surface of the contaminating chemicals, and replate with gold. However, if a circuit board has displayed this amount of contamination, recleaning and plating is not advisable. To insure the board's reliability, it should be refabricated.

How To Guard Against Contamination:

Although contamination does not occur in every gold-plated board, the possibility is always present. Preventive measures must be considered that can be applied both by the manufacturer and user of circuit boards. Personnel responsible for the design and inspection of the boards should become familiar with the plating processes and problems, including the techniques which manufacturers can use to prevent or minimize contamination. Process specifications on gold plating should be developed by the user so that specific precautions can be taken by the manufacturer to meet these specifications. Also, it is important that gold plated boards and the gold plating process itself be thoroughly investigated for possible replacement.

Possible Replacements for Gold Plating

In discussing possible replacements for gold plating it must be understood that this replacement is for the gold plating on the conductor patterns and plated-thru-holes, not the connector fingers. Gold is required for plating of terminal or connector fingers because they must withstand the wear of considerable plugging and unplugging from mating connectors and, at the same time, provide maximum conductivity. The copper fingers are first plated with nickel. Then gold is applied over the nickel to prevent any loss of the gold plating resulting from the continual plugging and unplugging. Gold also virtually elim-



An assembly worker is shown here dip-soldering the conductor side of a printed circuit board prior to ultrasonic cleaning.



Prior to final inspection, all printed circuit boards are given an ultrasonic cleaning.

inates the oxidation that can occur when the boards are kept on the shelf six months to a year before assembly. Finally, gold is very compatible with solder, which flows freely over the plated surface.

Many plating materials have been considered as possible substitutes for gold. These include tin, silver, nickel, lead-tin, and fused tin; however, all have relatively short shelf lives and high oxidation rates. The ideal approach is to eliminate plating altogether. This elimination will depend on arriving at a practical solution to the problem of protecting unplated copper circuit patterns from oxidation during a six months to year storage.

SOLDER PLATING:

Although it seems possible to use solder plating in place of gold, the plating bath must be controlled carefully, for this acid bath must not degrade the bond between the copper foil and laminate. Solder plating is generally done from a fluoborate bath (pH 0.2). Some work has been done with hot solder dipped boards, and this form of pre-tinning has proven quite satisfactory for single and double-sided circuitry without through-connections. Plated-thru holes, however, tend to fill with solder and necessitate considerable hand work to free them for insertion of leads.

LACQUER COATING:

Various lacquers have been tested as possible solutions to the problem of protecting the unplated copper circuit. In a prototype laboratory, four single-sided boards were fabricated and, immediately after etching, treated with one of four water-dip lacquers. No special consideration was given to the consistencies of the lacquers or their application. The lacquered boards were permitted to dry for three days, then subjected to humidity and temperature tests which duplicated the climatic conditions prevalent in the northern section of California. The conclusions drawn from these tests demonstrated the possibility of using water-dip lacquers as protective coatings to obtain a satisfactory shelf life for unplated copper conductor patterns.

After fluxing and dip-soldering the lacquered boards, it was found that the solder adhered to the copper without any difficulty. Additional tests were performed on double-sided boards with plated-thru-holes. These boards were also coated with the water-dip lacquer, permitted to dry, then all components mounted, and the conductor side of the boards fluxed and dip-soldered. Results of these tests disclosed that the solder adhered to the lacquered conductor patterns, filled the holes, and formed good fillets around the component leads.

There is a definite problem involved in protecting the copper circuit on a two-sided board that has been lacquered but not pre-tinned. Since the component side of a board is never dip-soldered and the ultrasonic cleaning given to all boards removes the lacquer, some method must be found to insure maximum insulation and resistance to oxidation. Studies have been made of unplated copper-etched boards sprayed with silicone shellac or an epoxy coating after ultrasonic cleaning. Although these boards were from one to five years old, they showed no evidence of copper oxidation, or cracked, peeled, or flaked coatings. The answer seems to be in using this type of final protective coating for the unplated board.

Cost of Gold Plating Versus Lacquer Coating

To determine the average cost of gold plating a printed circuit board, a survey was made of prices charged by five different board manufacturers. The prices quoted, per board, ranged from ten to twenty cents per square inch for plating 0.000050 inch thick. At the prices quoted, the cost of gold plating a typical circuit board averages between $1.00 and $1.75. Estimates provided by the same manufacturers indicated that the lacquer-coating process would save approximately $1.00 per board. It can be assumed that the savings in dollars alone to circuit board consumers will accelerate the development of an adequate replacement of gold-plated connector patterns.

Although it is a recognized fact that microminiaturization of circuits will eventually replace the printed circuit board, microminiaturization is too costly at the present time to become the standard method of electronic packaging. Until replaced by microminiaturization, the printed circuit board still has use and can serve industry well.

Science for the Coatings Technologist

Part XVII. Dispersion Continued: Individual Mills.

By E. S. Beck.

IN our discussion of dispersion, we have considered so far the general principles involved in the process, and a number of the machines used in dispersing pigments in the preparation of paints. (See March, April, Nov. and Dec. 1960 issues of METAL FINISHING.) We will continue with the discussion of the more important individual machines, or mills.

Kneaders

Kneaders, or dough mixers as they are frequently called, are machines which were originally developed for use in the baking industry. They have only been used for about the last 25 years in paint production.

The machines which we have now under discussion are extremely heavy-duty mills, with high power consumption: in the neighborhood of one horsepower per gallon of rated capacity.[1] They are not to be confused with machines of somewhat similar appearance which are suitable for use only as light-duty mixers.

The kneaders are made with a divided base, with sigma-type arms or blades moving in each section. The blades approach each other, generally with different speeds. The clearance from the bottom is quite close. As the sigma blades close in towards each other, a great deal of shear is produced. There is also much shear in other parts of the milling system, such as along the bottom.

The principal dispersing activity of the kneader is to produce enormous shear. In order to accomplish this, the paste must be very high in consistency. Best results are obtained with very highly viscous vehicles, such as alkyd or urea-formaldehyde resins.

The charge is usually not simply dumped into the dough-mixer. As a proper consistency must be maintained at all times, the charge is usually built up a little at a time, by adds of pigment and vehicle until the proper load and the proper consistency are obtained. The charge must not be too liquid or inadequate shear will be obtained. Neither must it be too stiff or dry or the paste will simply break. The desirable consistency is where the entire mass forms a whole, resembling dough, pulling away from the sides as the kneading action forces the mass down towards the center and under the blades.

If the paste is correctly formulated, there will be little sticking to the walls or bottom. It is good practice, however, to scrape down the sides once or twice during the operation.

The outstanding advantage of the kneader is that it produces extremely good dispersions of those pigments for which it is suitable. In the case of titanium dioxide, for instance, it yields the best available dispersion. No other method produces as sharp a gloss or so stable a dispersion at high pigment content. For this reason, the kneader is very widely used in preparing appliance white enamels, where the ultimate in dispersion is required.

As high as 75-85 per cent of titanium dioxide can be dispersed in the paste in the kneader. It is much too stiff for handling in this state, however. Consequently, a reduction must be made in the mill so that the paste can be discharged. A certain amount of caution must be observed during this reduction, adding the let-back vehicle gradually, until the viscosity of the paste has been partly reduced. It is advisable to start the reduction with the mixer operating at the slow speed used for the preparation of the dispersion. After the process is well under way, the balance of

the mixing can be done at the fast speed. Even after reduction with additional vehicle, dispersions of titanium dioxide made on the kneader will run from 60 to 70 per cent pigment.

In most cases, while an extremely good dispersion of titanium dioxide can be prepared in this manner, there will still be a small proportion of "specky" agglomerates. These can be removed in a number of ways, of which the best and most convenient is centrifuging. As a rule, centrifuging of the batches is considered standard practice when making high-quality appliance whites by means of the kneader.

The dough-mixer does an outstanding job with a rather limited number of pigments. It is of little value in the case of those pigments which are hard, gritty, require particle size reduction or are otherwise hard to disperse. It is of most value in whites, where it finds the greatest degree of usage in production. To some extent it is also used with chrome yellow, chrome orange, molybdate orange, and other easy-dispersing pigments.

Under the proper conditions, batches are rather quickly prepared. In general, the dispersion process itself takes in the vicinity of 30 minutes. In all, including the let-back, loading, unloading, etc. a batch can be prepared in about 90 minutes. This is rather fast production, and compares favorably with the roller mill. Other advantages are, of course, the superior dispersion and keeping qualities. Also, the machine is considered easier to operate than the roller mill. Many users find the dependability of the mill in producing batch after batch of uniform quality is greater than that of the roller mill.

The kneader can be jacketed so that pastes can be heated or cooled. Some operators utilize stiffer pastes by applying heat to obtain greater plasticity. This is the sort of detail which must be worked out for a specific formulation in a specific factory.

Most of the commercially available dispersions of titanium dioxide in alkyd resins or amino resins are prepared on the kneader. The extremely good gloss, excellent stability and high pigment concentration make the dispersions prepared on the kneader very salable.

Baker and Vozzella[2] have made an interesting study of the kneader, comparing it with the roller mill and the pebble mill. A standard finished enamel, consisting of titanium dioxide (anatase) in alkyd resin and mineral spirits, was made on the three different mills. In each case, a paste formulation was adopted which gave optimum performance in the particular mill it was to be used with.

Studies were also made of the power requirements of each mill, it being known that the kneader requires enormous amounts of power. For example, a 100-gal. capacity kneader requires 100 horsepower; a three-roller mill 20 horse power; and the pebble mill 20 horsepower.

Both the output of the mills and the power consumption were converted into values per gallon of finished product to make comparison simpler. In the cases of the specific mills reported on, the pebble mill produced about 30 gallon of finished paint per hour; the roller mill about 115 gallons per hour; and the kneader over 150 gallons per hour (137 to 171 gals. per hour). The high values for the kneader were produced because of two important factors: (1) The short time to put a batch of paste through the kneader and (2) the high pigment concentration of the kneader paste, yielding a high output of finished enamel.

In all cases, the times used were merely the actual time of the dispersion. No allowances were made for let-back, clean-up, unloading time, or other factors. The figures as given were calculations, based on actual experimental data. Published figures from the literature (which were also given) showed an even greater lead for the kneader.

When these data were reduced to horsepower per gallon per hour, the roller mill showed as the most economical, being in the range of 0.2 to 0.3. The kneader was next, requiring 0.6 to 0.7 horse power. The pebble mill was the highest in horsepower requirements, being around 0.75. The computations based on figures given in the literature show the kneader in an even more favorable light.

The kneader is a rather expensive mill, and is quite large in comparison with other mills of comparable capacity. This factor would also have to be taken into consideration before any conclusions on the economics of this mill could be finally made.

Banbury Mixer

The Banbury is similar to the kneader. The principal differences are that the feed and delivery are vertical; that there is a piston or plunger to compress the mix and force it between the blades; and that the entire mechanism is enclosed. This enclosing reduces the danger of fires in the case of solvents of low flash points, such as are used in nitrocellulose lacquers.

The Banbury is a rubber and plastics mill, and is quite widely used by that industry. It is rather a rarity in the paint industry. It does a good job on dispersions in nitrocellulose, and finds its chief paint application in preparing these. Dispersions in nitrocellulose are quite difficult to prepare if a high gloss is desired. The Banbury is the most convenient method of doing so.

Vinyl dispersions can also be prepared on the Banbury mill, but the best in gloss is not obtained. The Banbury is the only mill, however (other than the two-roll rubber mill) on which vinyl dispersions of any gloss can be made. New techniques of dispersing with the pebble mill can give a good gloss in some circumstances with vinyl resins, however.

The Banbury is considered a rather expensive mill initially and also to operate, because of high power requirements. However, it is probably no more expensive in operation than the kneader. It is generally kept as a special-purpose mill for certain difficult dispersions, and is not used as a multi-purpose mill, such as the roller mill.

Two-Roll Mills

Two-roll mills are sometimes called chip mills or rubber mills. The term chip mill refers to the fact

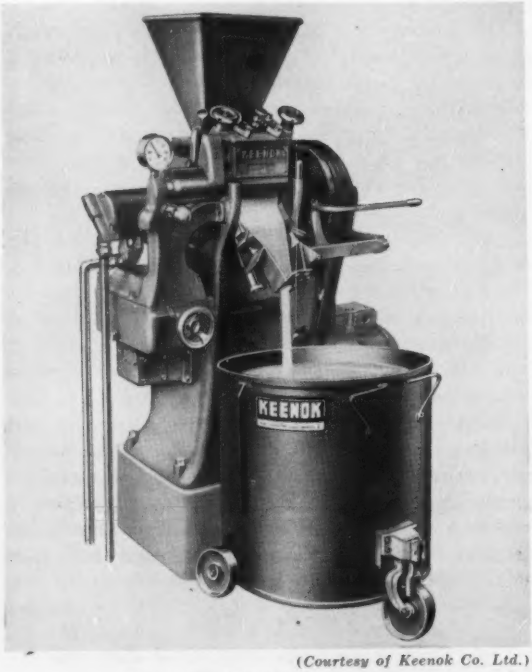
that the end-product, in the case of most paint dispersions, is a very hard sheet which is broken into chips for convenience of handling. The name rubber mill owes its name to its extremely wide usage in the rubber compounding industry.

Two-roll mills are not normal components of the battery of mills to be found in the average paint factory. On the contrary, they are actually quite scarce in the industry. Some firms specializing in nitrocellulose lacquers or vinyl coatings use them. And all firms making nitrocellulose or vinyl dispersions for sale use them as the machines of choice for high gloss dispersions in these binders.

The machine consists of two chilled steel rollers rotating toward each other at different rates of speed. The clearance between the two rollers is close, and enormous pressure is exerted on the material between them. A penny placed between the rolls while the mill is operating will be pressed and flattened out to an oval sheet as though it were soft plastic. The space between the rolls is set wire than in the case of three-roll mills.

In the case of the three roller or the five roller mill, which the chip mill resembles to some degree, the paste is continually passing over the mill and off the front roller onto the apron. To keep the paste a longer time between the rollers, it is necessary to return paste from the apron or collecting tank to the back rollers and pass it through the mill a second time, and for as many additional repasses through the mill as are necessary.

With the two-roll mill, the procedure is entirely different. The dispersion is held on one of the rollers, and is subjected to the shearing and smashing action of the rollers until it is taken off the mill. The mix is prepared in an extremely heavy state, with no solvent present. The mix is frequently so stiff that it is a hard, brittle solid when cold. The heat generated by the milling process is needed to convert the mix into a plastic mass.



(Courtesy of Keenok Co. Ltd.)

Fig. 1. The uniroll mill in operation.

A careful formulation of the original mix is necessary. The dispersion must be such that it will stay on the roll, and be capable of being cut or sheeted off in a single piece. It cannot be so soft that it sticks to the rolls with any tenacity, as it must come off the roll leaving a clean surface behind when it is cut. It must not be so soft that it oozes or drips from the rolls. At the same time it must be sufficiently plastic under the conditions of operation that it will form around the roller and undergo the shearing without breaking.

The processing operation consists of holding the mix on the rolls for a prescribed length of time. This is generally 15-30 minutes for most paint items. The mix is worked between the rolls until it assumes the plastic form and spreads out the length of the roll. It then wraps itself around one of the rolls. When this occurs, it is cut off by the operator and thrown back between the rolls once more. The process is repeated until the mix has been held on the mill the necessary length of time.

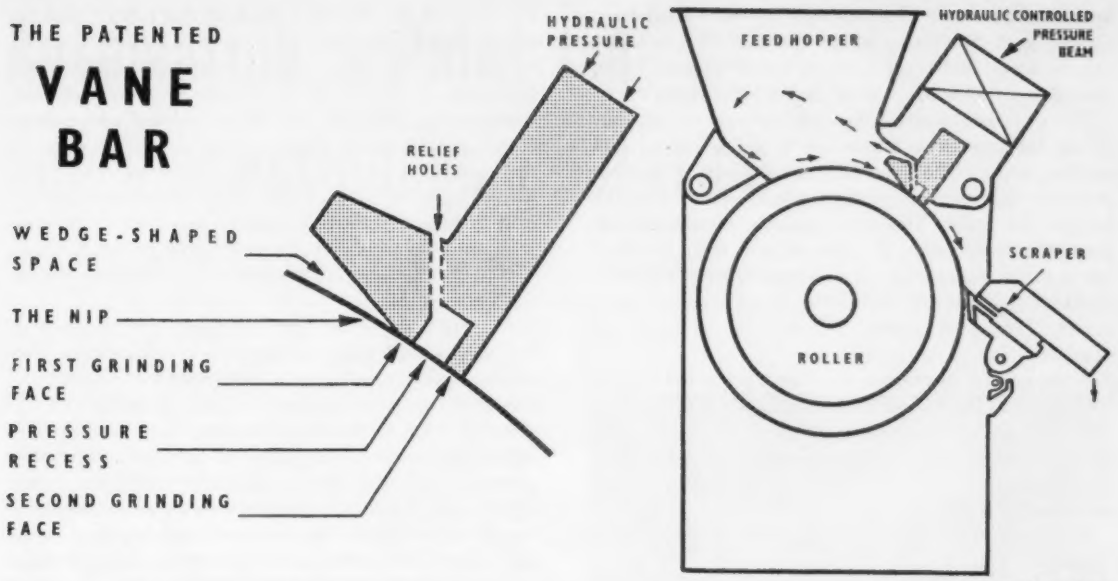
The time of dispersion is important with this type of mill, since there is no easy way of rating the dispersion quickly, as in the case of every other mill. The finished chips or stiff sheets cannot be checked on the grind gauge. They must be first cut back with additional vehicle to obtain the necessary liquid state. This cutting back must be slowly and carefully done to obtain valid results. That makes the procedure sufficiently complicated and time-consuming that most operators prefer to allow enough milling time to obtain complete dispersion and a little over without need for intermediate checking.

Frequently, lubricants, such as stearates or mineral oil, are added to the mix to cut down sticking to the roll. The amounts of these must be kept down to reasonable amounts in order to avoid introducing undesirable contaminants in significant amounts into the dispersion. In some cases, they must be avoided altogether.

The rolls can be cooled by circulation of water. They can also be heated by steam or hot water. This is necessary to soften very stiff plastics. The temperature and the timing depend on the nature of the mix to be dispersed on the mill.

In the case of elastomers and rubbers, the process of milling on the two-roll mill is often referred to as "breaking down" the plastic product. Often a rubber (such as neoprene) is milled without any pigment, for the purpose of increasing its solubility. The more the rubber is worked on the mill, the greater its solubility becomes. However, a degradation of the rubber also occurs, resulting in poorer performance properties. Thus the minimum of "breaking down" needed to produce the desired solubility is generally applied.

The colder the mill, the less degradation occurs. Neoprene for solution coatings is usually broken down for only a few minutes on a cold mill. This increases



(Courtesy of Keenok Co. Ltd.)

Fig. 2. Schematic outline of the uniroll principle, which illustrates the remarkably simple and rugged design of the machine.

the solubility enough that solutions can be prepared at a reasonable solids content, with almost no loss of properties. Stabilizers, curing agents, and fillers can be worked into the neoprene at the same time, if desired.

Dispersions in neoprene or other rubbers are usually fairly soft and flexible. Those made in nitrocellulose or vinyl resins are quite hard and brittle. The rubbery dispersions are fairly easy to cut back into coatings or solutions. The hard type, or chips, are quite difficult to cut unless correct procedures are used.

When chips are fresh, 24 or 48 hours old, they are usually rather soft, and easy to cut. After a few days, however, they become very hard, and insoluble. This indicates one advantage for a user who makes his own chips: they can be cut back while they are fresh.

But the majority of users of chips purchase them from specialists in dispersions. In this case, the chips will be very hard and insoluble when they are cut back. The best way to cut them is with the appropriate solvent in a kneader. Pebble mills can also be used; and some manufacturers are now finding it possible to cut chips quite well in a high speed impeller mixer.

Once cut, the chips may be kept in a paste form for convenient use. Cut chips may also be purchased in paste form, at an increased price, of course. Many manufacturers use these as convenient shading or color bases for small batches of vinyl or nitrocellulose enamels.

The value of dispersions made on the two roll mill is the high gloss they yield. No other method of dispersion yields as high a gloss, possibly because no other method does as much work on the paste during the dispersion process.

In the case of vinyl resins, there is no other practical way to obtain a really high gloss except by chipping. Procedures have been worked out for high gloss dispersions by other methods, but these do not yield the high gloss of the chips, nor do these methods work under all circumstances. The position of nitrocellulose dispersions is about the same.

Of course, in formulations where substantial amounts of other resins are included, the pigment can sometimes be dispersed in the added resin or plasticizer. Inferior gloss is usually obtained, and often shock problems in letting back the paste are encountered.

The chip mill is expensive to purchase and to operate. Dispersions made on it are costly, and are used only where the results obtained cannot be equalled by a lower-cost method. That chip dispersions have obtained wide usage among manufacturers speaks for the quality of products they yield.

Uniroll Mills

We have considered three roll mills, five roll mills and two roll mills. That does not complete the roster of mills based on rollers. A single roll mill exists, and has attained a certain degree of usage. This uniroll mill (see Fig. 1) is an English product, and is used much more in England than in America.

A number of American companies have adopted this mill, however, and its use seems to be growing. Those who have experience with this mill find it practical and economical, provided its use is restricted to those dispersions which it does best.

The machine consists of a large roller which rotates forward against a scraper and apron like the front roll of a three roller mill. But here the resemblance stops. The roller also moves back and forth parallel to the scraper while it is rotating. The scraper is of unusual efficiency; the manufacturer claims it removes 95% of the film from the roller at each rotation. This assures maximum efficiency from the machine.

The actual grinding action comes from a vane bar which presses against the roller as it rotates (see Fig. 2). This bar is forced against the roller by a positive

hydraulic pressure. The pressure can be varied by a control knob from zero up to 750 lbs. This pressure can be duplicated from batch to batch without variation, thereby effecting a good degree of uniformity.

The vane bar contacts the roller at two places, thus giving the paste two exposures to the grinding and rubbing action. The vane bars are made in a number of types, each varying in the angle it makes with the face of the roller. The vane angle most suitable for a specific formulation is selected, and then specified (as is the pressure) for all subsequent batches of that formulation. Bars are made at 5, 10, 15 and 20 degree angles. For most paints, 20 degrees is taken as standard.

A pre-mixing operation is necessary for the uniroll mill, as it is for the three and the five roll mills as well. The pre-mixed paste is placed in the hopper, which is just above the roller. The flow of the paste is down onto the roller, which picks up a film of the paste and carries it under the pressure bar.

This bar meets the roller at one of the above-mentioned angles. The smaller the angle, the more slowly the paste passes through the space between the vane bar and the roller. Once through the first vane (each vane presents a surface of $\frac{3}{16}$ inch) the paste enters a recess before passing under the second vane. This space is vented so that any build-up of paste is relieved by flowing back into the hopper.

The paste still adhering to the roller then passes under the second vane of the bar, receiving its second smashing and smearing action in the mill. In this way, the paste is given two mulling actions as it passes under the bar.

The manufacturer of the mill states that the very high pressure and shear which is applied to the paint is determined by four factors: consistency of the mix; viscosity of the binder; speed of the roller; and the angle of the vane-bar.

The machine is an excellent mill for grinding soft pigments. It does a very good job on whites, yellows, oranges, etc. This mill may be considered where there is no reduction in pigment particle size to be accomplished. It is not good for coarse or rough pigments, such as silica, magnesium silicate, etc. In the case of blacks, reds, and organic pigments in general, it is not outstanding, but can be used in many cases. The proper selection of dispersing vehicle is helpful in the latter instances.

For pigments of the type for which it is best suited, the uniroll mill shows a number of advantages. The output is very rapid; up to 400 gallons of enamel per 8-hour shift, in the case of the 26 inch mill.

In addition to the rapid output, there is the additional advantage of simplicity of operation. When the pressure and the bar angles are established, the operator need only set the machine up to the standard specifications. After this, his principal duty is to keep the hopper filled with paste, and to remove the tanks of dispersed paste as they are produced. One operator can keep three uniroll mills in operation without undue effort.

Another advantage is the ease of loading (as compared with pebble mills) and cleaning-up. The mill is ideal for small batches. The paste can be pre-mixed, ground through the mill and let back into enamel in a few hours. The mill is easily cleaned and is ready for another batch or another color in a short time.

The mill is relatively heavy, and requires a firm mounting on concrete. This is not normally an important factor, but might influence the selection of the point of installation in an older plant.

(To be continued)

Magnesium-Containing Coating Improves Hot-Dip Galvanizing

AN improved process for the hot-dip galvanizing of steel has been announced by *The Dow Chemical Co.* A six-year evaluation program has indicated that corrosion protection is improved 20 to 90 per cent in industrial-marine atmospheres when a slight amount of magnesium is added to the galvanizing bath.

The new process resulted from production operations in the Metal Cleaning Department of the company's Texas Division. Testing has been conducted since 1955 at industrial-marine sites in environments aggressive enough to cause coating failure within six years.

Studies have shown that very significant improvements in corrosion resistance are obtained when magnesium is present in amounts of 0.04 to 0.05 per cent by weight in the galvanizing bath.

The company's evaluation program also indicated that magnesium can be added to and maintained in a galvanizing bath without difficulty, it facilitates the galvanizing operation in such areas as drainage and icicle formation, and the increased cost is negligible when compared with the increased benefits.

The magnesium-containing coating produces a satin-white silver appearance but, as with coatings containing no magnesium, it is dependent on the amount of aluminum used in the bath. The most attractive coatings are obtained with a magnesium concentration of 0.03 to 0.05 per cent and an aluminum concentration of 0.003 to 0.004 per cent.

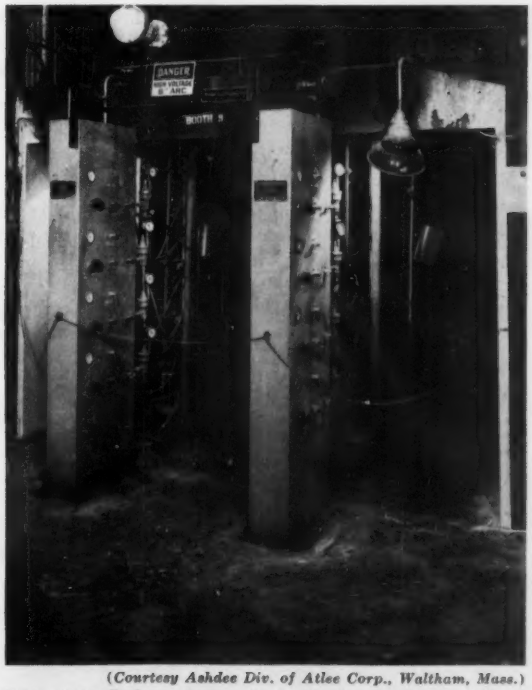
Automating a Paint Line For Discontinuous Operation

By Donald J. Fumagalli, *Works Mgr. and Chief Eng., Ashdee Div., Atlee Corp., Waltham, Mass.*

THE Automatic Electric Company of Northlake, Ill. produces equipment and components for telephone systems, and related electrical apparatus. When they recently decided to build a new plant, their engineers resolved that it should feature a finishing department where pre-cleaning, painting and baking would be done as nearly automatically as possible, despite the variety of parts and their intermittent production.

The requirements stated, in essence, that the system must accommodate a conveyor with a varying load, i.e., parts would be hung on the hooks as they were produced, so that there would be periods of heavy loading, and other times when many of the hooks would be empty. The paint thickness had to be uniform at approximately 0.8 mil, and the finish had to meet rigid requirements for appearance, hardness, and durability.

The paint application system that was finally chosen was of the electrostatic type consisting of a single booth equipped with a high voltage unit and two flush



(Courtesy Ashdee Div. of Atlee Corp., Waltham, Mass.)

Electrostatic flush-panel gun stands. Despite constant and heavy use, the buildup of paint on booth walls and surrounding equipment is negligible.



(Courtesy Ashdee Div. of Atlee Corp., Waltham, Mass.)

Relay box covers are shown emerging from the spray booth after final coating and baking. Note the absence of a drip-line or other evidence of sagging, or overruns.

panel gun stands, each stand having four spray nozzles. The conveyor speed is 6 ft. per minute, and has a provision for rotating the parts as they pass through the spray.

The problem of handling intermittent work loads was solved through the use of photoelectric eyes, adjusted to trigger the sprays only when an object enters the spray zone.

Paint thickness and uniformity is maintained with a formulation consisting of four parts paint to 1¾ parts solvent, to acquire a 19-sec. viscosity on a No. 2 Zahn cup. On the average, 144 large relay cases can be painted with a gallon of paint, maintaining the required 0.8 mil thickness. The appearance is characteristic of electrostatic spray painting: smooth, even, and uniform, with a gloss which is precisely controlled. After receiving two coats of gray baking enamel, the parts are carried on the conveyor to an overhead baking oven, where they are baked for approximately 15 minutes at 325°F.

Control of a Copper Fluoborate Plating Bath

By Larissa Domnikov, *Process Analyst A, Norair Division, Northrop Corp.*

A METHOD of rapid deposition of copper from a bath containing copper fluoborate and free fluoboric and boric acids was developed and is being used at one of the Russian plants. The control of this bath was reported by three Russian chemists in the monthly publication Plant Laboratory.[1]

The method is based on the electrolytic deposition of copper from the solution sample, and subsequent hydrolytic decomposition of fluoboric acid by boiling in the presence of magnesium sulfate. As a result, sulfuric acid is liberated, and its concentration is equal to the concentration of fluoride ions:

$$HBF_4 + 2MgSO_4 + 3H_2O \rightarrow 2MgF_2 + 2H_2SO_4 + H_3BO_3$$

Sulfuric acid can be titrated with a base in the presence of methyl red indicator. Boric acid, both the residual and that liberated in the hydrolysis process, can be titrated in the presence of bromthymol blue indicator with mannitol or invert sugar. The analysis takes 3-4 hours and gives good results (see Table).

TABLE

Results of the analysis of the electrolyte (g./l.)

Solution Constituents	*Calculated Concentration*	*Results of the Analysis* 1	2	3
$Cu(BF_4)_2$	440	440	440	440
Total concentration of HBF_4	325.5	326	324	325
Free HBF_4	None	1	None	None
Total concentration of H_3BO_3	244.5	243.2	241.4	261.0
Free H_3BO_3	15	15	16	17

Method of Analysis

Take a 2 ml. sample of electrolyte and place in a 300 ml. beaker. Dilute with distilled water to 100-150 ml., heat to 60-70°C., and deposit copper electrolytically on platinum gauze electrodes with the current at 0.5-1 amp. After 30 minutes, when the electrolyte becomes colorless, check the completeness of copper deposition by increasing the level of the electrolyte in the beaker, adding distilled water. If, in ten minutes, there is no indication of copper film on the surface of the immersed cathode, the electrolysis is complete.

After the completion of electrolysis, quickly exchange the beaker with electrolyte for a beaker with distilled water, turn off the current, thoroughly wash the cathode with water and alcohol, dry at 100-150°C., and weigh.

To analyze for fluoboric and boric acids, place the filtrate in a 500 ml. volumetric flask, fill with distilled water to the mark, thoroughly mix, and transfer 50 ml. of solution to a 500 ml. conic flask. Add to this solution 75 ml. of saturated solution of magnesium sulfate and 100 ml. of distilled water, and boil for at least one hour, using a reverse condenser.

Cool the solution, wash the condenser with distilled water, and titrate with standard alkali in the presence of methyl red indicator until the color changes from pink to yellow. The fluoboric acid solution concentration in grams per liter can be calculated according to the following formula:

$$HBF_4 \text{ total} = \frac{A \times K \times 0.002195 \times 1000 \times 500}{2 \times 50}$$

where A is the amount of alkali in ml. used for the titration; K is the normality of the alkali; 0.002195 is the conversion coefficient for fluoboric acid; 500 is the dilution; 2 and 50 are the solution samples in ml. taken for analysis. The concentration of free fluoboric acid is found by subtracting:

$$HBF_4 \text{ (free)} = HBF_4 \text{ (total)} - (Cu \times 2.76)$$

where Cu is the concentration of metallic copper in grams per liter, and 2.76 is the conversion coefficient for fluoboric acid tied up with copper.

To determine the total concentration of boric acid, add to the solution, previously titrated with methyl red, 1 ml. of bromthymol blue indicator, 1 gram of mannitol, and titrate with standard alkali until the blue color remains stable for one minute.

The total concentration of boric acid is calculated according to the following formula:

$$H_3BO_3 \text{ total} = \frac{A \times K \times 0.006184 \times 100 \times 500}{2 \times 50}$$

$$H_3BO_3 \text{ (free)} = H_3BO_3 \text{ (total)} - HBF_4 \text{ (total)} \times 0.7041$$

Here 0.006184 is the conversion coefficient for boric acid, and 0.7041 is the conversion coefficient from fluoboric to boric acid.

Reference

1. E. N. Lukasheva, N. M. Baram, and V. G. Kuznetsova, Zavodskaia Laboratoria, No. 9 (1958).

Institute of Metal Finishing Conference, Llandudno 1961



Opening ceremony of the Conference. At the microphone is the chairman, Councillor R. Roberts, J.P. Seated are A. A. B. Harvey (President of the Institute), Dr. S. Wernick and Dr. J. E. Garside.

By Nathaniel Hall, *Technical Editor*

THE 1961 Annual Conference of the British Institute of Metal Finishing was held in Llandudno, Wales, on May 2nd to 6th, with an unusually large attendance of about 450. The magnificent mountains and coastline of Northwest Wales provided a memorable setting for the meeting which, alone, would have made the long trip from the United States worth while.

The conference opened with technical sessions on Wednesday, May 3rd, both in the morning and afternoon. In the evening, those registered for the conference were guests at a reception and dance tendered by the chairman and members of the Llandudno Urban District Council, at the Cafe Royal.



E. F. Marlow, R. Fairfax-Naylor, Dr. H. A. Kellner of Lea Mfg. Co. (U.S. and England), and G. A. Moodie enjoying a cup of tea.

After the third technical session on Thursday morning, lunch was followed by a tour of the nearby plant of A.E.I. (Hotpoint) Ltd., where the visitors were shown the steps in the manufacture of appliances, including a very modern organic finishing department. This reporter, however, accepted an invitation, by *L. G. Beresford*, editor of METAL INDUSTRY, who graciously drove him through the countryside on a tour which terminated in Caernarvon Castle. On remarking about the excellent condition of various silver trophies in the castle, we were informed, confidentially, by the attendant, that a coating of clear lacquer was responsible.

On Thursday evening the Seventh Hothersall Memorial Lecture was presented by *Dr. Abner Brenner*, of the National Bureau of Standards, the 1961 Hothersall medalist. Dr. Brenner's address, describing the production of tungsten nozzles by gas plating, was unique not only because of the ingenious manner in which he associated his most interesting subject with metal finishing, but because he spoke without notes of any kind. This precedent-setting accomplishment drew well-deserved admiring comments and compliments from the audience.

Technical sessions were held during the morning and afternoon on Friday, and the conference concluded with a dinner and dance at the Winter Gardens.

Sixteen papers were presented on various subjects of interest to the metal finisher, abstracts of which follow. Because most of these had been preprinted in time for those attending the conference to look up information and prepare comments, the technical sessions were exceptionally rewarding. Since the authors presented only short reviews of their papers, ample time remained for complete discussions, which often disclosed additional information.

ABSTRACTS OF TECHNICAL PAPERS

The Influence of Addition Agents on the Composition of Nickel Deposits

By A. H. Du Rose
(Harshaw Chemical Co.)

It is shown in nickel plating that the cathode polarization is increased by the brightener, and that this can account for a more complete reduction of the sulfur in the sulfo-oxygen organic 'control agent.' The control agent contributes sulfur to the deposit, but no significant amount of carbon, the sulfur being reduced and cleaved from the control agent molecule. A nitrogen-containing organic brightener contributes both carbon and nitrogen to the deposit. The rate of increase in sulfur content of the deposit with respect to an increase in control agent concentration is inversely proportional to the control agent concentration. An increase in carbon in the deposit is accompanied by an increase in hydrogen and oxygen. The cause of brightness is discussed.

Electrodeposition of Ruthenium

By F. H. Reid & J. C. Blake
(International Nickel Co. (Mond) Ltd.)

Exploratory plating tests have been carried out on a number of aqueous electrolytes based on simple ruthenium salts and nitrosyl derivatives. The nitrosyl sulfamate electrolyte emerges as the most immediately useful solution, furnishing smooth, bright deposits of ruthenium up to 0.0002 in. thick over a fairly wide range of operating conditions. Cathode efficiency is always low and, under preferred operating conditions, is in the range of 10-20%. Deposits show internal tensile stresses in the order of 20-30 tons/in^2 and fine cracks may be present at thicknesses greater than 0.0001 in. Cracking is reduced by addition of aluminum sulfate to the electrolyte. The simple sulfamate solution and an electrolyte based on reaction of sodium tetranitro-nitrosyl-ruthenate with sulfamic acid give slightly better performance than the nitrosyl-sulfamate solution when freshly prepared, but are considerably less stable in operation.

Leveling Action During Electrodeposition in Nickel and Acid-Copper Solutions

By S. A. Watson
(The Mond Nickel Co. Ltd.)

The effects, on leveling, of variations in agitation, pH and temperature are shown to be in accord with a hypothesis of leveling action put forward earlier. Measurements of leveling power on microgroove record masters are found to indicate satisfactorily the relative leveling action to be expected on commercially abraded surfaces. Cathode-potential measurements have been made with 60 addition agents in nickel solutions and with 30 in acid-copper solution and, where application of the hypothesis to the potential values promised strong leveling action, actual leveling powers were measured. In all such cases, high values were obtained. A method is described which permits rapid identification of leveling agents, by means of a simple cathode-potential change, ΔE_m. It is shown that a non-leveling agent such as saccharin can modify the behaviour of a leveling agent. Published polarographic results are empirically related to leveling action, and it is demonstrated that certain groupings in the addition-agent molecule favor leveling.

Electrodeposition in Plain Bearing Manufacture

By P. G. Forrester
(Glacier Metal Co. Ltd.)

Electrodeposition has been used for providing bearing linings of numerous different materials. Silver and silver-lead are the only electrodeposited materials which have been used on a large scale to provide complete linings. Plating however, is, the standard method for providing the thin lead-base overlay on copper-lead bearings, which are among the principal high duty bearings in current use. Much attention has been given to means of applying thin overlays reliably and accurately. The performance of overlays is limited by liability to fatigue, cavitation and wear, examples of which are given in the paper. Electrodeposition is also widely used as a corrosion protection for bearings and to assist in obtaining a bond in various types of bimetal.

The Corrosion of Decorative Nickel + Chromium Coatings: A Metallographic and Potential Study

By G. N. Flint & S. H. Melbourne
(International Nickel Co. (Mond) Ltd.)

The morphology of pits in decorative nickel+chromium coatings resulting from service corrosion in an industrial atmosphere has been compared with that of pits produced in accelerated corrosion tests. Corrosion in the three accelerated tests examined and in the early stages of service corrosion was frequently characterized by formation of hemispherically



Some of the visitors at the conference. Delegates attended from Belgium, Czechoslovakia, France, Germany, Italy, Netherlands, Poland, Sweden and the United States.

shaped pits in the nickel layer: these occurred at discontinuities in the chromium top-coat. In the later stages of service corrosion, say, after several years' exposure, pits were more often of irregular shape. In copper+nickel+chromium coatings, none of the accelerated tests gave close reproduction of the type of pit produced by corrosion in service. In double-layer nickel+chromium coatings, however, the type of pitting experienced in service was reasonably well reproduced by the acetic acid/salt spray and the *Corrodkote* tests, but not by the SO_2 test. In order to obtain a better appreciation of the electrochemistry of the pitting corrosion observed, measurements were made of the anode polarization characteristics of electrodeposited nickel and copper foils and of wrought steel, in electrolytes simulating those used in the accelerated corrosion tests. The results of these measurements are discussed in relation to the metallographic observations.

Experience With an Ion Exchange Process for the Recovery of Water Polluted in Metal Finishing Operations

By A. A. L. Pearson & G. G. Parker
(Morris Motors Ltd., Radiators Branch)

A process is described, based on ion exchange, for dealing with waste water from metal finishing operations. It provides a recirculatory system of water supply with an average flow of 7500 gal./hr. in a 90 hr. working week. From an input of wastes containing mixed metal ions, chloride, sulfate, and cyanide, a good quality demineralized water is obtained for recirculation.

The initial difficulties of operation and the remedies adopted to overcome them are described, and an estimate is made of costs of the scheme and of alternatives to it.

An Improved Technique for Measuring Cathode Overpotential During Electrodeposition

By J. K. Prall & L. L. Shreir
(Battersea College of Technology)

The determination of the activation overpotential/current density relationship (η_A—i) during the electrodeposition of metals is subject to errors owing to the changing surface topography of the substrate. Under these circumstances, the true current density varies continuously as electrodeposition proceeds. To overcome this difficulty, a technique has been developed which involves the use of a platinum cathode which is coated with a very thin deposit of copper prior to each determination of η_A at constant i. Removal of the deposit is effected anodically and automatically terminated before oxygen gas can be evolved. This avoids the possibility of gas bubbles adhering to the platinum and causing errors in the subsequent plating stage. Although the studies have been confined to copper, it is considered that the method is of general application. The preparation of copper sulfate electrolytes has been investigated and, using highly purified electrolytes in conjunction with the techniques described, it has been found possible to obtain linear Tafel lines during the electrocrystallization of copper.

Influence of Composition and Heat Treatment of Carbon and Low Alloy Steels upon their Response to the A.R.D.E. Smoothing Process

By W. A. Marshall, Vera J. Sanders & R. A. F. Hammond
(War Office; Armament Research & Development Establishment)

The response to the A.R.D.E. oxalic acid-peroxide smoothing process of a range of low carbon, medium carbon and low alloy steels in various conditions of heat treatment has been investigated. The effects studied include brightening, smoothing, rate of dissolution, periodicity of electrical potential of the steel during treatment, and the formation of smut. Tentative theories are proposed, relating the behavior of the steels to their composition and metallurgical condition.



Palmer H. Langdon, publisher of Metal Finishing, and his wife, Anne, are shown with John A. Bechtold, director, M. L. Alkan Ltd.

The Influence of Pre-Plating Processes on the Porosity of Electrodeposits on Steel

By M. Clarke & S. C. Britton
(Tin Research Institute)

The electrochemical method of obtaining a numerical index of the porosity of electrodeposits, previously described by the authors, has been applied to a study of the effects of preplating preparation of steel. Five different rolled steels and coatings of nickel, tin-nickel, tin and speculum were examined. The validity of the test method has been verified by comparison with laboratory and exposure tests yielding visual indications of porosity. It was found that the depth of steel removed by any method of preplating preparation had an influence on the porosity of the coating sufficiently large to obscure, if it were not controlled, effects of difference in preparation method. The removal of the extreme surface layer of steel (about 0.00001 in.) influences the porosity of the applied coating for better or worse according to the metal deposited and the conditions of deposition. Evidence was obtained that this effect depends on the form of crystal growth of the deposit. With deeper uniform penetration into the steel, zones were reached which were apparently features of the steel and influenced porosity almost independently of the character of the deposit. These zones are attributed to bands of nonmetallic inclusions. The observed effect of depth of penetration helps to explain the divergent results previously obtained in investigations of surface preparation. It suggests that, in practice, when controlled penetration cannot be expected, no method of surface preparation will give consistent porosity of deposits on a range of steels. The response of an undercoating to the condition of the steel surface was found to govern the porosity of a composite coating. Well-chosen undercoatings therefore, may offer the best method of obtaining consistent results and of reducing porosity.

Calorimetric Determination of Metal Coating Thicknesses on Small Objects

By G. Krijl & J. L. Melse
(N. V. Philips Gloeilampenfabrieken)

The heat developed during the solution of a metal is utilized for measuring coating thicknesses. The measurement is carried out in a simplified calorimeter. When the relationship between the heat developed and the coating thickness has been determined for a given product, further measurements can be carried out in a rapid and easy way. The method is especially suitable for measuring the average coating thickness on small mass-produced articles which are fabricated regularly on long

production runs. The authors have applied the method for measuring the coating thickness of nickel on stainless steel, of zinc and cadmium on steel, and of silver on phosphor-bronze.

One-Year Exposure Tests on Anodized Aluminum

By J. A. Whittaker & J. M. Kape
(Fulmer Research Institute, Aluminum Laboratories Ltd.)

Twelve sheet aluminum alloys, and five extruded alloys, each with various anodic film thicknesses prepared under commercial conditions, have been exposed at a severe industrial (SE London) and a marine (Portsmouth) site. Protection increases with increasing film thickness and is greater when the specimens are freely exposed rather than sheltered. The thickness required for protection is less with the higher purity alloys.

The Selection of Finishes for Communication Equipment

By W. Marchand
(Standard Telephones & Cables Ltd.)

The factors governing the selection of a finish are discussed and the properties of the available material are considered in relation to them. The constructional materials are steel, copper alloys and aluminum alloys, and treatments to give protection while retaining other properties, include electroplating, metal spraying, chemical treatment and organic finishing. Special consideration is given to the relative merits of zinc and cadmium coatings for the protection of small parts, the uses of silver, rhodium, and gold for contacts and other electrical applications, and requirements for soldering and spot-welding. Modern trends are discussed with mention of printed circuits, miniaturization with the increased hazard from whisker growth and magnetic drums as memory devices.

The Selection of Finishes for Protection and Decoration in the Automobile Industry

By R. J. Brown
(British Motor Corp.)

The underlying requirement for the appropriate type of finish is discussed, whether it is applied for the purpose of corrosion protection alone, or for the combined purpose of protecting against corrosion and for decoration.

Consideration is given to temporary and semi-permanent corrosion protectives, and to the need for their complete removal if permanent coatings are to be subsequently applied. Permanent corrosion protection results from the combination of formulation of the coating and its thickness in the case of organic finishes, and the choice of such finishes is related to their location and to the method of application. The need for adequate pre-treatment is stressed, and reference is made to the claims made for zinc coated sheet steel as a material for motor car construction.

The advent of clad materials is briefly considered, together with the relative merits of electrodeposition as a method of achieving a decorative finish, in comparison with the claims made for competitive materials such as stainless iron, brightened and anodized aluminum, and plastics.

The Use and Value of Laboratory Tests of the Durability of Paint Coatings

By J. A. W. van Laar
(N. V. Philips Gloeilampenfabrieken)

Some simple tests are described by which the reactions of a painted cold-rolled steel panel under certain mechanical and climatic influences can be determined. The tests are not meant primarily to imitate the complex and various influences to which a painted article is subjected in practice but to illustrate the result of certain influences.

It is important that tests should be reproducible and give quantitative results that can be communicated readily. The following mechanical tests are described:—



E. L. Masek, R. N. Harris and F. R. Cook during lighter moment.

(1) Indentation, using a Vickers pyramid with a specified load for a defined time;

(2) The paint surface removed by a number of standardized nuts falling from a fixed height is measured;

(3) The effect of a standardized stylus which removes the paint completely is measured the width of the track.

These results together with other conventional tests give a measure of the "damageability" of the painted object.

A mechanism is suggested for the changes observed in three environment tests. A pure water immersion test is described. An interpretation of the salt spray test is given. An underrust test is described in which the samples are kept at a constant relative humidity below 90% and standard conditions produced by dosing with the stimulants encountered in practice. Individual environment tests instead of, or in addition to test cycles are advocated.

A measurement of the surface texture of steel using three instruments intended for measuring the thickness of a non-magnetic layer on a ferro-magnetic substrate is described. The influence of coating thickness on climatic durability is discussed. The tests are intended to aid the selection of a paint system for a given purpose.

New Developments in Painting Equipment

By A. L. Newcomb
(Newcomb-Detroit Co.)

Developments in conveyors, phosphating, paint dipping, spray booths and ovens, for the processing of automotive bodies are reviewed. Present trends are examined and discussed and the necessity for increasing knowledge in certain areas before further improvements can be made is stressed.

Selection and Testing of Finishes for Domestic Appliances

By R. Warburton
(A.E.I. Hotpoint Ltd)

Selection of finishes is based on the appearance required, durability for service, ease of application and cost. Close co-operation between product designer and paint manufacturer enables a preliminary choice to be made and, after preliminary tests on panels, trials with appliances are made to assess suitability for processes, assembly, packaging, and distribution. The quality of the finish finally chosen is checked in production by thickness measurements and occasional destructive tests of appliances.

SHOP PROBLEMS



METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gladly received and the sender's name will be kept confidential, if desired.

Anodizing Aluminum

Question: In reading "The Surface Treatment and Finishing of Aluminum and Its Alloys" by S. Wernick and R. Pinner, mention is made of a process by which a barrier type anodic coat can be applied to aluminum, which process was developed by G. Hass and N. W. Scott.

We are most interested in getting more detailed information along these lines, as to whether or not this process has ever been used in a feasible production procedure. Any information you may be able to send us will be appreciated.

H. S.

Answer: You can probably obtain photostats of the article from the New York Public Library or the Engineering Societies Library in New York.

Barrier type anodic coatings are usually employed for electrical condensers, not as a finish for aluminum.

Gold and Rhodium Thickness Testing

Question: We are having a problem determining thickness of our gold on nickel and rhodium on nickel. Are you familiar with tests such as jet solution tests or magnetic testing, or any relatively fast test for this determination?

We are trying to avoid cross sectioning and observation by microscope and chemical separation since this would take too long for the amount of tests we would like to set up each day. Thicknesses of precious metals would be in the range of 20 to 50 millionths of an inch.

N. P.

Answer: We know of no jet or magnetic test method for very thin deposits of gold and rhodium.

Gold thickness can be determined with an electronic anodic stripping instrument. However, rhodium is insoluble in stripping solutions, and can only be determined by dissolving away the basis metal and weighing the remaining deposit. Gold can also be determined in this manner or by weighing the finished piece, stripping off the deposit and reweighing.

Porosity Test for Anodized Aluminum

Question: We have been using the following spec for checking anodized parts: Immerse parts in beaker with 5% cupric chloride solution. Keep immersed at 75°F. for three minutes. If spongy copper is deposited, anodic coating has failed.

Have you ever run across this test? If so, I would like to know where it comes from. Our supplier claims this test is much too tough. What do you think?

T. C. T.

Answer: The use of a copper salt for testing the porosity of oxide films on anodized aluminum was first suggested, according to our records, by Hill & Mason in 1942 (Metals & Alloys, **15**, 972).

Your copper concentration is much higher than suggested by the above investigators. Their solution consisted of the following:

Sodium chloride	20 g./l.
Cupric nitrate	1 "

Copper will deposit in the pores in 5 to 30 minutes.

Submerged Anode Rods

Question: In the "Electroplating Engineering Handbook" there is mention of the use of submerged steel anode rods, in electrical contact with a plain steel tank, being used in zinc plating. We have used this arrangement in several installations, barrel and still tank, with good results. However, we now notice that the walls and bottom of one of these tanks are corroding very evenly at a rapid rate.

We would greatly appreciate any assistance or suggestions that you might offer.

R. K.

Answer: We doubt whether the use of submerged anode rods is contributing in any way to the corrosion. It is more likely that the cause is salts from the water supply or drag-in from a previous acid dip.

It should be remembered that all unlined metal plating tanks are anodic because the solution between the anodes and the tank walls is an electrical conductor. Therefore, submerging the anode rods only increases the amount of anode surface in the solution.

"Butler" Finish

Question: We are interested in learning something of the old "pumice and water" method for satin finishing sterling silver. Do you have a bibliography on the subject?

Do you know whether or not a greaseless compound is currently being made that will give a pumice and water type finish to sterling?

H. W.

Answer: The "pumice and water" method produces what is known as "butler" silver. Pumice powder and water are applied to the silver surface and brushed with a fine nickel-silver or brass wire scratch-brush rotating at about 850 r.p.m.

Greaseless compounds will produce a satin finish but not a butler finish.

Gold Recovery from Strip

Question: I would like to submit a question as follows: In stripping gold from brass with conc. sulfuric acid, where can we obtain the proper form of carbon or graphite (cathode) if recovery of the gold is desired? We prefer this method since cyanides etch the brass. What method if any is used to

recover the gold from the acid?

G. C.

Answer: When using the anodic sulfuric strip for gold on brass, the gold does not plate out on the cathode but remains in the solution as a metallic mud. Therefore, the type of cathode employed is not important. To recover the gold, the strip should be allowed to settle, and the solution decanted, after which the mud can be washed with water and dried.

Analysis of Chromic Anodize

Question: The article by Prelinger in the November 1960 issue of METAL FINISHING was most interesting and completely explained problems I encounter with an 1,800 gallon chromic acid anodizing bath. However, my recollection of chemistry is somewhat faded, and I sorely missed a detailed analytical procedure in the article, which probably gave sufficient information for a practicing chemist. Could you please forward, at your earliest convenience, a procedure I could use for determination of free and total chromic acid. The book "Elementary Quantitative Analysis" by Willard & Furman refers to ferrous ammonium sulfate as a poor choice of standard reducing agent for the determination of hexavalent chromium. Incidentally, I would prefer to use a large sample size for accuracy.

S. N. B.

Answer: Using a 25 ml sample of anodizing solution, add 100 ml water in a 250 ml beaker and titrate electrometrically with standard sodium hydroxide solution (approx. 1 N.) to pH 3.05-3.15.

ml NaOH x Normality x 4.00 = g./l. Free Chromic Acid

For the degree of accuracy required in an anodizing bath, the ferrous ammonium sulfate method for total chromic acid is satisfactory. Since an electrometric pH meter will be available for the free chromic acid determination, the total hexavalent chromium can be titrated directly, thus avoiding the usual procedure of adding an excess of ferrous ammonium sulfate and back-titrating with standard permanganate or dichromate solution.

Using a 10 ml sample, add 100 ml water in a 250 ml beaker and titrate electrometrically with standard ferrous ammonium sulfate (approx. 1 N.). ml F.A.S. x Normality x 3.33 = g./l. Total Chromic Acid.

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Science for Electroplaters

66. Nickel - Hardness Tensile Strength

By L. Serota

THE constantly expanding field of electroplating encompassing the application of electroplated parts to engineering as well as decorative purposes emphasizes the need for producing electrodeposits that will meet, more precisely, the specifications relating to such mechanical properties as hardness, tensile strength, and ductility. Significantly, appreciable variations in the properties of electrodeposited nickel and the correlation of these variations in properties to different operating conditions have been reported by a number of investigators.

A number of theories have been advanced to account for these variations in hardness of electrodeposited nickel, based upon the conditions of operation which, W. A. Wesley notes, result in a higher hardness than that of the wrought form of the metal. The presence of hydrogen in solid solution, or as a hydride, as a contributory factor in the cause of hardness, a view which previously found many supporters, is not considered as satisfactory now as the generally accepted theory. The current theory, proposed by D. J. McNaughton and his co-workers, is that hardness is associated with fine grain size resulting from the presence of inclusions (colloidal) as basic nickel compounds.

Hydrogen Theory

The factors which give support to the hydrogen theory (of hardness) are based upon the indication that metals such as iron, chromium, nickel, and cobalt, exhibiting pronounced difference between hardness in the electrodeposited and wrought forms, show high capacities for dissolving hydrogen (atomic) at room temperatures (and, in some cases such as nickel, have lower softening temperatures than the wrought forms) with subsequent distortion of the nickel crystal lattice and the interference of crystal growth resulting from the adsorbed film of atomic hydrogen or the formation of a surface hydride.

In contrast to this view, D. J. McNaughton indicated in his investigation of hardness of electrodeposited nickel that the amount of hydrogen retained in solution is not enough to account for the hardness obtained. In association with A. W. Hothersall, the authors note in a paper on the hardness of electrodeposited nickel, that although differences in structure (crystal size) of the deposited nickel are shown to be largely determined by the effect of hydrogen, the importance of hydrogen as a factor in influencing hardness, based upon the amount of hydrogen discharged, is not substantiated by results they obtained. Cathode efficiency measurement, for example, showed that the amount of hydrogen discharged at the cathode, for solutions giving hard and soft deposits (deposits differing in structure and physical properties) respectively, was approximately the same.

The two types of solutions they used consisted of (a) nickel sulfate, ammonium sulfate, and potassium chloride in varying amounts (pH from 5.5 to 6.15, 35°C., 1 amp./ft.^{2}), and type (b) nickel sulfate, boric acid, and potassium chloride operating under the same conditions applied for bath a. The average cathode efficiencies recorded for baths a and b were 98.35 and 98.52 per cent respectively. The average Brinnell hardness was 294 for bath a and 162 for bath b.

D. J. McNaughton & R. A. F. Hammond showed similarly that, although the cathode efficiency was increased from 98.8 per cent to 99.2 per cent, when the pH of a solution was raised from pH 4.7 (4.9 colorimetric) to 6.9 (7.1) and the hydrogen discharge was reduced, the hardness increased from 190 to 418. The structure of the deposit was also found to change from coarse to very fine grain size. The relationship is effectively shown in Fig. 1. They also found that hard deposits gave, in addition to fine crystalline structures, higher tensile strength and resistance to abrasion than soft deposits.

This view is also expressed by A. Brenner, who reports that, in his investigation of magnetic thickness measurement (nickel), poor correlation was found between the amount of hydrogen and hardness in nickel de-

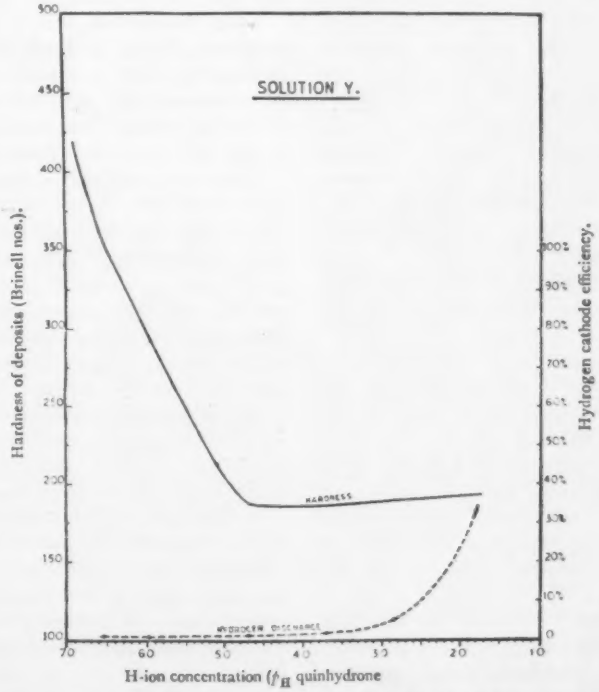


Fig. 1. H-ion concentration (pH quinhydrone).

posits. His observation led him to suggest that other factors, such as grain size, may influence hardness.

Additional contrasting views to the hydrogen theory are indicated by W. A. Wesley, who refers to the evidence that about 90 per cent of hydrogen present in electrodeposits can be removed without appreciable softening, by warming in a vacuum. A. Brenner and associates, in their investigation of physical properties of nickel, refer to the fact that removal of hydrogen from nickel deposits by annealing (400°C.) is possible without appreciable lowering of the hardness.

Inclusion Theory

Inasmuch as J. D. McNaughton and his associates found that no direct relationship between hardness and the amount of hydrogen discharged can be established, the suggestion, previously advanced, that hardness of electrodeposited nickel is associated with the basic material precipitated colloidally from the film close to the cathode face, was substantiated by their results.

Thus, varying amounts of basic matter co-deposited at different pH ranges, and corresponding to different hardnesses, are attributed to such factors as (a) changing pH values in the liquid film at the cathode face, resulting in the solution attaining a value corresponding to the precipitation pH or a lower value; (b) variations in film thickness, maintained at precipitation pH with increased hardness, due to increased amounts of basic material made available for codeposition by increasing film thickness.

The positively charged colloidal nickel hydroxide or other basic compound will be occluded on the crystal face of the deposit (inclusion), thereby interfering with crystal growth, a condition resulting in the formation of fine-grain size which accounts for the hardness of the deposit.

Additional support for the view that films of basic material (colloidal) are included around the crystals of deposited nickel, was the effect of annealing upon such hard deposits. With increasing grain size, breakdown of the films (inclusions) may result in sufficient concentration of such material to become visible under the microscope. G. E. Gardam & D. J. McNaughton observed such black spots, under a microscope, in annealed, polished, unetched nickel samples. They considered such spots non-metallic inclusions. Increase in grain size was obtained by E. J. Roehl by annealing a nickel deposit (1550°F.) from a Watts bath, pH 5.0, 130°F., 40 amp./ft.^{2}. The grain size was very large.

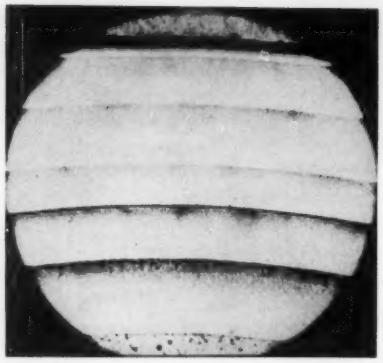


Fig. 2. Structure of deposit, showing laminations. X 40.

W. A. Wesley & E. J. Roehl associated band structure (rhythmic banding) in hard nickel deposits with periodic variation in the colloidal material (nickel hydroxide or other basic nickel compounds) deposited with the nickel, an effect attributed to diffusion mechanism. The changes in pH at the cathode liquid surface account for the changes in rate of migration and deposition of the charged colloidal particles, an effect causing periodic changes in structure and composition of the deposited metal.

When the deposits were thicker than 0.01 inch, Wesley & Roehl observed a laminating effect, a macroscopic type of striation with poor adhesion between the layers. This condition, they found, was due to the greater hardness of the inner surface of the specific layer than that of the outer surface. Fig. 2 is a photomicrograph showing such laminated structure.

The softer portion of the layers, it will be observed, shows evidence of more rapid attack by the etchant and appear coarser grained. Thus, the hardness (Vickers) of 3 layers of laminated nickel deposited at a temperature of 127°F., current density 50 amp./ft.^{2}, pH 5.6 to 5.7, and removed mechanically, is for several runs, respectively, 514, 566, and 409 for the hardness of the first, second, and third inner surfaces; and 503, 466, and 380 for the hardness of the corresponding outer surface. Thicknesses in inches of the respective layers were 0.08, 0.11, 0.07.

(To be continued)

FOREIGN LITERATURE

Chemical Oxidation Processes for Aluminum

Galvanotechnik, **47**, No. 6, 264.

The various chemical oxidation processes which have been developed and are in use, have certain features in common. Processing is conducted with aqueous (generally hot) solutions. By virtue of the oxidation reaction which occurs, the boundary surface solution/metal is alkaline at the metal side. It is important, accordingly, that the solution has continuous fresh access to the metal surface. Substances should be present in the bath which give the freshly-formed oxide coating an open texture and so keep the way to the basis metal free for the solution.

The best-known and most widely used processes of this type are the MBV and EW processes. The MBV process is used for pure aluminum and for the aluminum-magnesium and aluminum-manganese alloys. Two main bath formulations are used for the MBV process. These are as follows:

1. Sodium carbonate ..... 50 g./l.
   Sodium chromate ..... 15 "
2. Sodium carbonate ..... 65 g./l.
   Sodium dichromate ... 15 "

Both baths are worked at 95 to 100°C. with a dip time of 5-15 minutes.

The parts oxidized in these baths can be subsequently colored with dyestuff solutions, as in anodizing. Whether colored or in the natural condition, it is always necessary to give an end treatment, which serves to close the pores. A suitable final treatment bath is a 1-3% solution of sodium silicate, at a temperature of 90°C. and a dip time of 5-15 minutes. A thorough rinsing should be given between the two treatments, and after the final treatment. A final dip is given in hot water and the ware dried. Sawdust should not be used for drying; it is better to use a warm air flow.

The EW treatment process is used as a passivating treatment for aluminum surfaces, as a corrosion-protective treatment for the aluminum-copper alloys, and as an adhesion ground surface for subsequent paint coatings. It is of particular importance for the treatment of the aluminum-copper al-

loys. The bath has the following composition:

Sodium carbonate	50 g./l.
Sodium chromate	15 "
10% sodium metasilicate solution	1 "
Temperature	90-95°C.
Time	10-20 minutes

As will be noted, the main difference in this process is the inclusion of the metasilicate in the bath, to transform the somewhat unpleasing gray-green coloration obtained with the MBV process into a colorless, transparent coating.

Considerable variation is possible with both processes, with regard to the bath composition and operating conditions, for the alloy being treated.

Electropolishing Stainless Steel

H. Benninghoff: *Galvanotechnik*, **47,** No. 11, 497.

The author gives details of electropolishing stainless steels of the chrome-nickel, 302 type. The work was conducted on a large scale, in electropolishing units of 400 liters capacity. During the course of this work, it was found that the operation, control, and regeneration of the baths was simple to to carry out in practice, and that the results obtained were very good. The stainless steel parts treated showed not only a highly polished surface but, with respect to their corrosion-resistance behavior, were found to be considerably better than similar surfaces which had been mechanically polished.

The distance between the anode and cathode in the polishing bath, was 100-150 mm. The electropolishing layout was normal. Two different electropolishing solutions were used during the course of this work. Bath No. 1 is used preferably for sheet and strip. Bath No. 2 is better for wire or tubing.

Bath No. 1

n- Butyl alcohol	10-50% vol.
Orthophosphoric acid (85%)	90-50 " "

This bath has a very wide range with regard to the mixture ratio of the two components.

In the case of ferritic types of stainless steels, the bath composition is held within certain limits and the bath composition in this case is:

n-butyl alcohol	15% vol.
Orthophosphoric acid (85%)	85 " "

Steel, copper or copper alloys can be used for the racking material. Clamp contacts should be provided; simple suspension racking of the parts to be electropolished is not sufficient. The cathodes are stainless steel or copper.

The bath temperature is 50°-75°C. A better polish and more effective leveling can be obtained in the higher temperature range. About 60°C. can be chosen as an average temperature. The bath can also be worked at room temperature if the current is raised correspondingly. The bath is operated at 6-12 volts and current densities of 0.1-0.2 amp./cm.^{2} Local superheating can occur if current densities higher than this are used. Treatment time is 2-10 minutes.

Bath No. 2.

Citric acid	55-60% wt.
Sulfuric acid	15-20 " "
Water	30-20 " "

A lead-lined bath is used with this solution. Cathodes are electrolytic copper or chemical lead; copper is best.

The bath works between 80° and 100°C. The temperature should not be allowed to drop too much, to avoid the citric acid crystallizing out. Make-up water, when required, should be warm. A current density of 0.05-0.1 amp./cm.^{2} is used. A new bath works better at the high side of this current range, up to the point at which sufficient metal has been dissolved in the bath.

As with Bath No. 1, the treatment times lie between 2 and 10 minutes, about 25 microns are removed from the metal surface. After the electropolishing treatment, the parts are rinsed and neutralized in a 1% solution of caustic soda.

The bath becomes enriched in foreign metals, particularly copper, which can be removed electrolytically using carbon anodes and cathodes, worked under the same conditions as in electropolishing.

Chemical Polishing Baths for Copper and Copper Alloys

Galvano (Paris) **28,** No. 268, 234.

The bath containing a mixture of phosphoric, nitric, and acetic acids is suitable for treating copper, and monophase copper-base alloys containing either zinc or nickel, or the two together. The bath constituents will vary considerably in concentration according to the material being treated. The working ranges for the bath formulations used, are shown below. The presence of water in the bath is not regarded with favor and the maximum tolerated is 10% by volume.

For copper and copper alloys:

Phosphoric acid (d. 1.75)	30 to 90%
Nitric acid (d. 1.42)	5 to 20%
Acetic acid (glacial)	10 to 50%

For copper and alpha brass:

Phosphoric acid	55% (by vol.)
Nitric acid	20% " "
Glacial acetic acid	25% " "

Two further types of baths have been developed, containing respectively hydrochloric acid and sodium chloride. These additions probably act as inhibition agents in a phosphoric-nitric-acetic acid bath. The composition of these baths is as follows:

Nitric acid (d. 1.42)	20%
Acetic acid (d. 1.05)	25%
Phosphoric acid (d. 1.70)	55%
Hydrochloric acid	0.5%

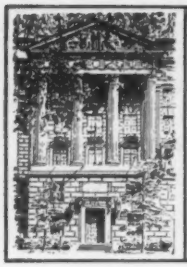
This bath is worked at 88°C. with treatment times of up to 5 minutes. The second bath is as follows:

Nitric acid (d. 1.42)	40%
Acetic acid (d. 1.05)	30%
Phosphoric acid (d. 1.70)	30%
Sodium chloride	1%

The addition of hydrochloric acid is stated to be particularly suitable for chemical polishing of Monel and other copper-nickel alloys. With the removal of 0.01 to 0.05 mm. of metal, the surface polish obtained reaches its maximum. Where the initial surface shows roughness, longer immersion in the bath can serve to give a smoothing effect.

Chemical polishing baths have certain limitations, as regards the types of alloy capable of being polished. Thus, generally speaking, the cast alloys are not suitable for chemical polishing, because of the alloy composition and the coarse grain size. In the case of forgings, the use of chemical polishing baths is limited to single-phase alloys, as mentioned above. Broadly, the degree of surface polish obtained will vary according to the grain size of the material. In general, a better polish is obtained on cold-worked surfaces than an annealed sheet. A material with a fine and uniform grain gives the best results.

It is an advantage to give a barrel polishing treatment before placing in the chemical polishing bath.



Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD

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Phosphate Conversion Coating

U. S. Patent 2,975,082. *Mar.* 14, 1961. *J. A. Henricks*

A phosphate coating bath make-up compound in powder form comprising 20 to 40 parts of zinc nitrate particles having a zinc oxide coating thereon, 2 to 20 parts of acid particles selected from a member of the group consisting of diglycolic acid and sulfamic acid with a coating of starch on its particles, 30 to 50 parts of mono-basic sodium phosphate, 10 to 30 parts of calcium chloride having a coating of calcium phosphate powder on its particles so that said composition can be mixed with water to make a non-sludging phosphate coating bath.

Wire Plating Machine

U. S. Patent 2,975,120. *Mar.* 14, 1961. *H. Kenmore and W. J. Manson, assignors to National-Standard Co.*

In an apparatus for electroplating metals, a bath structure and means for suspending and rotating a helically shaped wire so that at least the lower portion thereof is surrounded by said bath structure.

Paint Stripper

U. S. Patent 2,975,140. *Mar.* 14, 1961. *W. L. Yaroch, assignor to Klem Chemicals, Inc.*

A stripping solution for removing colored synthetic resin finishes which leave an adherent pigment deposit on a finished surface when treated with strong alkali materials, the solution consisting essentially of an aqueous solution of water, between about 3-50 per cent by weight of an alkali metal hydroxide, between about 0.5-10 per cent by weight of a material selected from the group consisting of alkali metal metasilicates and trialkali metal phosphates, between about 0.2-10 per cent by weight of an alkali metal resinate and between about 0.3-10 per cent by weight of a water soluble gluconate.

Continuous Vacuum Coating

U. S. Patent 2,975,753. *Mar.* 21, 1961. *O. W. Hayes, assignor to National Research Corp.*

In apparatus for coating a substrate by vacuum deposition of a material onto a substrate wherein the substrate is moved past a source of coating vapors in a coating chamber maintained under a vacuum, the improvement which comprises a passage defining a predetermined path for travel of the substrate, a plurality of coating chambers spaced from said path, means for deflecting said substrate out of its predetermined path into one of said coating chambers, and a vacuum-tight door for sealing each said coating chamber from said passage.

Electrostatic Spraying

U. S. Patent 2,975,757. *Mar.* 21, 1961. *H. J. Reindl, assignor to General Motors Corp.*

Apparatus for electrostatically painting an article, comprising in combination; a pressurized paint source, means for conveying paint from said source to an orifice, a rotating air moving device located remote from said orifice and adapted to be rotated at speeds above one thousand r.p.m., said orifice being positioned so that paint being emitted therefrom as supplied by said source will impinge tangentially upon the outer surface of said air moving device, and an electrostatic power means having opposite poles thereof connected respectively to said air moving device, and to said article.

Electrostatic Spraying

U. S. Patent 2,975,755. *Mar.* 21, 1961. *H. J. Reindl, assignor to General Motors Corp.*

In an electrostatic painting apparatus, the combination comprising; a plate-like distributing member of rectilinear shape having at least two pairs of sharp-edged sides wherein the edges of each pair are generally parallel to one another and wherein one pair of edges is of greater length than the other pair of edges, a support associated with the plate adjacent the geometric center thereof and adapted to be attached to means for rotating the support and the plate, and a cup-like supply means surrounding the support and depressed from the surface of the support and adapted to receive paint to be distributed therefrom over the entire surface of the plate-like distributor by centrifugal action and means for impressing an electrostatic charge upon the plate wherein paint distributed therefrom will bear an electrostatic charge.

Electrostatic Spraying

U. S. Patent 2,975,756. *Mar.* 21, 1961. *H. J. Reindl and J. T. Marvin, assignors to General Motors Corp.*

An electrostatic painting apparatus for painting of an article spaced therefrom with at least two different paints, comprising in combination; a distributor plate including a plurality of segmental portions each being adapted for connection to a separate source of supply of paint, a plurality of paint supplies for supplying different paints to the several portions simultaneously, means for rotating the distributor plate, and a source of electrostatic power for supplying opposite charges to the distributor plate and the article.

Immersion Tin

U. S. Patent 2,976,169. *Mar.* 21, 1961. *M. A. Streicher, assignor to E. I. du Pont de Nemours and Co.*

In a process for making a selected area of a steel sheet amenable to soldering, the steps comprising mechanically roughening such area and effecting an immersion deposition of tin thereupon by applying thereto an aqueous bath consisting essentially of:

	Parts by weight
Water	2400
Stannous sulfate	30±18
Sulfamic acid	270±50
Polyalkylene oxide having a molecular weight between 350 and 20000	48±16

Porcelain Enameling

U. S. Patent 2,976,171. *Mar.* 21, 1961. *J. D. Sullivan, assignor to A. O. Smith Corp.*

A method of applying a glass coating to steel, comprising blasting the

steel with a metallic grit having a particle size of 25 to 40 mesh to provide an average surface roughness in the range of 230 to 450 microinches, depositing a layer of nickel on the roughened surface with the nickel layer having a thickness in the range of 0.08 to 0.30 gram of nickel per square foot of steel surface, applying a coating of a vitreous enamel composition directly to the coated steel surface, and firing the vitreous enamel composition at an elevated temperature to fuse the vitreous enamel to the steel.

Rust Preventives

U. S. Patent 2,976,179. *Mar.* 21, 1961. *R. A. Westlund, Jr. and M. J. Furey, assignors to Esso Research and Engineering Co.*

A method for inhibiting the rusting of a metal which comprises coating the surface of said metal with an oil type rust preventive composition containing as the essential rust inhibitor 0.01 to 30 weight per cent of a salt selected from the group consisting of triethylene tetramine trioleate, and triethylene tetreamine tetraoleate.

Electroless Silver

U. S. Patent 2,976,180. *Mar.* 21, 1961. *R. R. Brookshire, assignor to Hughes Aircraft Co.*

The method of silver-plating comprising the step of contacting a surface to be plated with a plating solution at a temperature in the range of from about 50° to about 110°C., consisting essentially of an alkali metal cyanide, a dissolved hypophosphite reducing agent, dissolved silver ions, and an undissolved silver ion-containing compound in contact with the plating solution, the ion ratio of said hypophosphite ion to the undissolved silver ion being in the range of from about 0.33 to about 10, and the ion ratio of the cyanide ion of the dissolved alkali metal cyanide to the undissolved silver ion being in the range of from about 0.1 to about 10.

Electroless Gold

U. S. Patent 2,976,181. *Mar.* 21, 1961. *R. R. Brookshire, assignor to Hughes Aircraft Co.*

The method of gold plating comprising the step of contacting a surface to be plated with a plating solution containing a quantity of dissolved gold, a dissolved hypophosphite reducing agent, a gold cyanide complexing agent, and a quantity of undissolved gold cyanide in contact with the plating solution.

Conversion Coating — Aluminum

U. S. Patent 2,976,193. *Mar.* 21, 1961. *G. H. Pimbley, assignor to Purex Corp., Ltd.*

A process for producing a substantially colorless chemically bonded coating on an aluminum article, which comprises treating said article with an aqueous acid bath comprising a halogen-containing anion, an anion including a member of the group consisting of hexavalent chromium, molybdenum, tungsten and ferricyanide, a cation of the group consisting of zinc, cadmium, mercury, vanadium, chromium, manganese, iron, cobalt, nickel and copper, and an agent of the group consisting of a soluble thiocyanate, a soluble cyanate, thiourea, urea, cyanuric acid, thiocyanuric acid, soluble sulfur- containing compounds, soluble phosphorus-containing compounds, soluble ferrocyanides, soluble divalent and trivalent chromium compounds, hydro-quinone, quinhydrone and hydrazines, and forming a substantially colorless conversion coating of high corrosion resistance, the pH of said solution being about 1.5 to about 3.5.

Leveling Nickel

U. S. Patent 2,976,225. *Mar.* 21, 1961. *D. G. Foulke, W. B. Stoddard, Jr., O. Kardos and W. B. Kleiner, assignors to Hanson-Van Winkle-Munning Co.*

A process for producing a corrosion-resistant nickel electrodeposit substantially smoother than the basis metal to which it is applied which comprises electrodepositing nickel from an aqueous acidic solution of at least one nickel salt at a temperature in the range from about 135°F. to about 180°F. and at a pH from 3.0 to 4.5 while maintaining a saturation concentration of 3-bromocoumarin in the solution.

Conversion Coating — Zirconium

U. S. Patent 2,977,204. *Mar.* 28, 1961. *D. W. Shannon, assignor to the United States of America*

A method for improving the corrosion resistance of zirconium comprising immersing it in a first solution containing 39% by volume of 70% concentrated nitric acid, 4% by volume of 48% hydrofluoric acid and 57% by volume of deionized water; then rinsing it in a second solution containing 15% by weight of $Al(NO_3)_3 \cdot 9H_2O$ and 0.1 to 1.0 normal in nitric acid; then rinsing it in tap water and then rinsing it in deionized water.

Spray Gun

U. S. Patent 2,976,392. *Mar.* 21, 1961. *R. Wabnitz*

A heated spraying apparatus.

Vitreous Enameling

U. S. Patent 2,977,241. *Mar.* 28, 1961. *E. M. Oliver, H. P. Tripp, L. E. Fussell and F. L. Michael, assignors to General Electric Co.*

The method of treating a steel surface for application of a single finish coat of enamel which comprises the steps of cleaning said surface by means of an alkali cleaning solution, pickling the cleaned surface by means of a hot solution containing from 10 to 30 per cent phosphoric acid and having a controlled ferrous ion content of from 0.01 to 1.0 per cent by weight and a ferric ion content of from 0.05 to 3.0, to remove from the surface from 1.5 to 3.0 grams of iron per square foot of exposed surface, washing the pickled surface with a weak alkaline solution to remove therefrom phosphate coating formed during pickling of said surface, subjecting said washed surface to the action of a hot nickel sulphate solution containing from 1 to 4.0 ounces per gallon $NiSO_4 \cdot 7H_2O$ and 0.001 to 0.03 per cent by weight of phosphate ions until there is obtained on said surface a nickel flash coating between 0.02 and 0.35 gram per square foot of surface, rinsing the nickel coated surface with an alkaline neutralizing or inhibiting solution and then with clear water before drying said surface in preparation for the application of a one-coat porcelain enamel.

Chemical Copper Plating

U. S. Patent 2,977,244. *Mar.* 28, 1961. *S. E. Kay and R. J. Ball, assignors to Pilkington Bros., Ltd.*

A method of depositing a protective layer of metallic copper on a silvered mirror, which comprises separately spraying an aqueous solution of a complex cuprous salt and an aqueous acid solution simultaneously towards the silvered surface so as to mix the two sprayed solutions and thereby deposit a layer of metallic copper thereon.



Bright Zinc Bath

R. O. Hull & Co., Inc., Dept. MF, Rocky River, Ohio.

Applied to items in a wide range of sizes and shapes, under various environmental conditions, ROHCO 503 has performed with top efficiency in both still and automatic tank and barrel plating. It is reported to produce exceptionally uniform, high-quality deposits. In conduit boxes and items having deeply recessed areas, corners, crevices, seams, internal threads, etc., the brightener demonstrates strong throwing power to quickly produce uniform plate thickness and quality in hard-to-plate areas, it is claimed. It offers widest latitude of all tested, for tolerating extreme conditions, extended range of current densities, higher operating temperatures, bath compositions, etc. This unique stability permits important cut backs in processing time and practically eliminates rejects due to substandard plating.

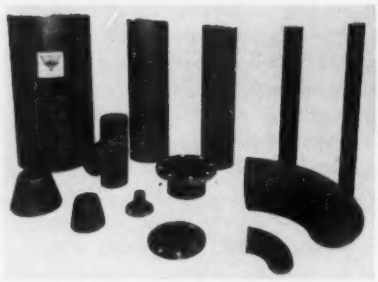
A high-concentrate, true liquid, the brightener is diluted extensively for use in large installations. It may be introduced to solution generously without danger of chemical over-sensitivity, unbalancing baths or wasting ingredients. It is available in 5 and 55 gallon, non-returnable drums.

Reinforced Plastic Pressure Pipe

Ceilcote Co., Dept. MF, 4844 Ridge Road, Cleveland 9, Ohio.

A standard line of corrosion-proof Duracor reinforced plastic pressure pipe, capable of withstanding pressures up to 100 psi at temperatures as high as 250°F., is available in 10- and 20-foot lengths and is furnished in fiberglass mat and cloth construction. Wall thickness ranges from ¼-to ⅝-inch, depending on pressure and temperature requirements. The company will continue to offer custom-fabricated pressure pipe to meet customer specifications.

The company also has announced the availability of standard joining



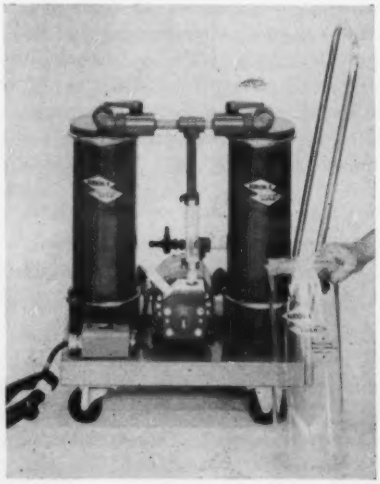
kits comprising all necessary materials for field joining. Special bulk kits are available for larger installations.

Gold Recovery Unit

Precious Metals Recovery Corp., Dept. MF, Nutley, N. J.

Aurion-X Gold Resin Reclaim is a fluid handling station utilizing twin-connected, clear lucite columns "charged" with PM/79 resins. It reportedly will remove over 97% of the gold present in either alkaline or acid solutions in one pass, even from "open-end" cascade rinse systems. The resins, which have a capacity of up to 30 troy ounces, absorb gold heretofore impractical to recover because of only trace amounts found in rinsing systems.

When saturated, the lucite cartridges can be returned intact for processing



as part of the reclaim-refine "package." Stand-by cartridges are said to be easily fitted to the unit, avoiding any interruption in reclaim-processing while original chamber contents are being refined.

Bright-Nickel Process

Metal & Thermit Corp., Dept. MF, Rahway, N. J.

A new Watts-type bath, that can be used with either air or mechanical agitation, gives high-brilliance deposits with excellent brightening rates and outstanding chromium receptivity.

Identified as Bright-Nickel 30-W, the new process offers excellent nickel deposition control on a wide basis-metal range. Stability of addition agents is assured over the 3.5 to 4.5 preferred pH range, even under varying operating conditions.

Nickel sulfate, nickel chloride, boric acid and organic addition agents make up the solution. Rolled or cast 99%+ carbon-type nickel anodes are recommended. Plating bath composition depends on cathode current density, type and finish of basis metal, deposit thickness and article to be plated.

Organic addition agents include Agent A-3 which contains a stable brightening material for mirror-bright, ductile deposits. Agent A-5 acts to promote maximum brilliance and ductility, while addition agents Y-11 or Y-15 inhibit pitting.

Platinum Plating Bath

Technic, Inc., Dept. MF, P. O. Box 965, Providence, R. I.

Pore-free deposits above 0.0001 inch can be plated easily with Platinum T.P., it is claimed. The bath is remarkably stable over broad operating conditions, and porosity is negligible even for deposits only 0.000050″ thick. Because of its brightness, hardness, and the inherent properties of platinum, it is also extremely well suited for use as an electrical contact surface.

The new product is supplied as a

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ready-mixed liquid concentrate. The bath, containing only the platinum complex, is described as exceptionally easy to control. The metal is plated from an acid bath at low temperature. There is no gassing at the cathode and therefore no possibility of gas pitting. Hardness of the deposit is 450 Vickers.

Plating on Aluminum

Enthone, Inc., Dept. MF, 442 Elm St., New Haven 8, Conn.

A new simplified method of plating on aluminum utilizing a dilute zincate solution, Alumon "D" is made up at a concentration of only 1 lb./gal. Compared with the viscous 4 to 5 lb./gal. conventional zincate bath, it is easier to make up; is freer rinsing; penetrates more readily into grooves, blind holes, and screw threads; reduces dragout; and minimizes carryover of zincate into subsequent plating baths.

Used after cleaning and acid dipping, the bath simultaneously activates the aluminum and deposits a thin, dense, uniform zinc film. This film can then be electroplated with copper, nickel, or other deposits with excellent adhesion. Immersion times vary from 15 sec. to 2 min. at room temperature.

The product is available as a powder or as a liquid concentrate, which may be used interchangeably, and either product, when used at recommended concentration, will produce a concentration of 1 lb./gal. of dissolved salts.

Control for Plating Rectifiers

Dresser Electric Co., Dept. MF, 2705 Wight St., Detroit 7, Mich.

A new automatic average current density control for plating applications approaches, as nearly as possible, true automatic control on continuous production operations where racks have approximately the same area.

This control incorporates ammeter, voltmeter, automatic - manual switch, raise-lower push-buttons and average current density controls. Controls may be furnished integral with the rectifier or for remote operation.

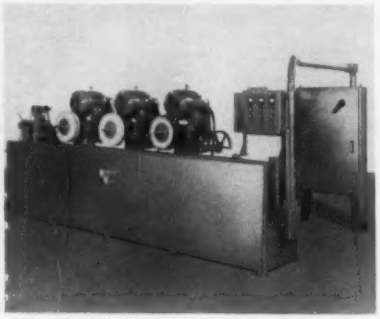


Polishing Comparator Machine

Murray-Way Corp., Dept. MF, P. O. Box 180, Birmingham, Mich.

Ideal production speeds, work pressures, and feed rates for polishing and buffing operations may be accurately determined in advance of actual production runs by a new, friction-free comparator machine. The versatile unit may also be used to test work wheels, horsepower usage, buffing and polishing compounds, and production parts or materials to assure that they meet standard specifications.

A specially designed conveyor moves the sample materials past a scouring head and three buffing heads. Wheel pressure is adjustable and entirely friction-free. Once wheel pressure is selected, it remains constant. Since machine inertia and drag are eliminated, the control panel readings are exact



and dependable. Spindle torque and wheel pressure may be quickly and accurately determined. The scouring head uniformly roughens the surface of sample materials for re-use in the testing.

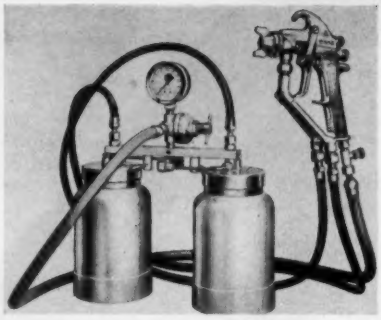
Heads are adjustable horizontally across the conveyor in a 5″ range. Elevation may be screw-thread adjusted in an 8″ range, and vertical float has a 6″ range. Heads may be angularly positioned up to 45° either side of center in a horizontal plane.

The machine also features selective pneumatic wheel lift-off, adjustable conveyor speed, and swing-out of scouring head when not required. Floor space requirement is 5½′ by 15′.

Spatter Spray Unit

Binks Mfg. Co., Dept. MF, 3140 Carroll Ave., Chicago 12, Ill.

A new spatter spray unit designed for two-color spray applications consists primarily of a Model 19 spray gun connected to two paint cups (either one-quart or two-quart sizes are available), an air adjusting valve, and the necessary hoses and fittings.



Different color paints are contained in each cup. Both colors flow in separate hoses to the spray gun where they are mixed just prior to being sprayed. A special double-fluid gun connection has been designed to fit on the spray gun. Controlled mixing inside the spray gun head insures the proper finished appearance.

Floor Coating Primer

Corrosion Engineering Prods. Dept., Pennsalt Chemicals Corp., Dept. MF, Natrona, Pa.

A primer for floor coating, which can be used on damp concrete surfaces, is being marketed under the name of Penntrowel Damp Surface Primer. It helps assure firm bonding in many cases where surfaces are believed to be dry, but actually contain some moisture. The new primer can be applied with a stiff brush after normal cleaning of the surface.

The primer is a two-component, semi-viscous, amber-colored liquid with a bonding strength greater than concrete, brick, or wood. Compatible with other Penntrowel resin products, it is resistant to acids, alkalies, oils, and solvents, and offers thermal shock resistance for floors subjected to sudden heat shocks.

One gallon covers 100 to 150 square feet, depending on the roughness of the surface. It is completely stable in storage for long periods.

Gold and Silver Cleaner

Margar Mfg. Labs, Inc., Dept. MF, 159 Marjorie Drive, Buffalo 23, N. Y.

"Electrical Components Grade Silver-Gold Cleaner" is specially formulated for use in the electronics, electrical, and associated metal finishing indus-

tries. It is a specialized product for the removal of tarnish or oxide discoloration on silver, gold and its alloys.

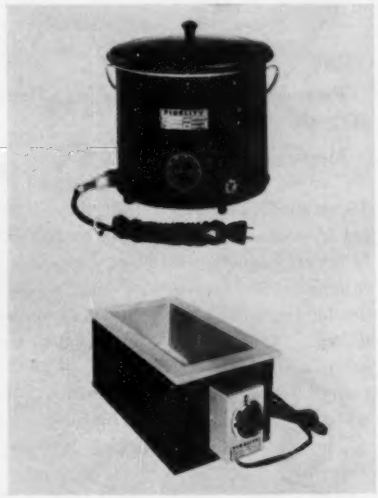
The manufacturer states that the cleaner facilitates soldering, reduces contact resistance, improves appearance, is safe for all silver and gold, and can be used over and over.

The cleaner is available in half gallons, gallons, and case lots.

Dip Tanks for Hot-Melt Plastic Coating

Fidelity Chem. Prod. Corp., Dept. MF, 470-474 Frelinghuysen Ave., Newark 12, N. J.

Circular tanks are available in capacities from one pint to five gallons. Capacities of the rectangular unit range from 0.1 gallon to 3 gallons. All



tanks are air insulated to give maximum efficiency at minimum operating cost, and are finished in black wrinkle enamel.

They are equipped with adjustable thermostatic controls which allow for automatically controlled working temperatures throughout all parts of the tanks. A special cast aluminum construction, combined with uniform heat distribution, prevents burning.

Bonded Graphite Coating

Superior Graphite Co., Dept. MF, 33 So. Clark St., Chicago 3, Ill.

Slip-Plate is a new, bonded graphite coating which comes in liquid form and can be brushed, sprayed, or rolled onto metal or wood quickly and easily to protect against rust, weather, acids, alkali, salts, etc. It air-dries in 10 to 15 minutes to provide lubrication and protection for long periods of time, according to the manufacturer.

It comes in two consistencies: No. 1 for heavy duty coating, containing larger particle-sized graphite, leaving a coating of approximately 7 mils in thickness; and No. 2, containing a finer size natural graphite, leaving an average film of 4 mils in thickness. The lubricant is available in one quart, one gallon, and larger containers.

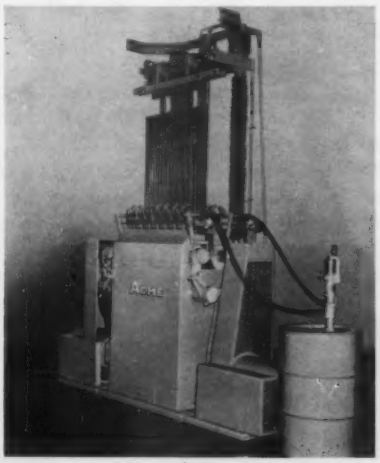
Vertical Sheet Polisher

Acme Mfg. Co., Dept. MF, 1400 E. Nine Mile Road, Detroit 20, Mich.

A new versatile, high production vertical polishing and buffing machine simultaneously finishes both sides of flat, angular or irregular shaped parts. The machine can accommodate parts up to 48 inches long and 36 inches wide. Length can be incrementally adjusted for parts under 48 inches in length. If parts to be finished are 18 inches or less in width, two or more parts may be finished at the same time. If only one side of the part requires finishing, parts such as flat sheets can usually be placed back-to-back, thus permitting a 100 per cent production rate increase.

Basically the machine consists of a working head that carries the fixtures and reciprocates the work vertically and horizontally between two rotating abrasive or buffing rolls. The part is reciprocated horizontally to eliminate any possibility of streak marks on the part.

The machine occupies a floor space of approximately 9′ by 4′ and varies in height from 6′ to 12′. One man can usually operate a number of these machines at the same time particularly when several machines are connected



by the conveyor system for a series of finishing operations.

Timely... in-process RUST CONTROL information



When rust puts a "Stop-Order" on your production, what do you do? Where in your production line do you look for the cause? How do you find the right answer . . . quickly?

① Send for the new Magnus Rust Control Data File now — it can help you to increase your knowledge of rust . . . its cause and solution.

② At the first sign of rust troubles, call your local Magnus Man (we'll give you his name, address and phone number). He's a specialist whose knowledge and experience in both cleaning and rust prevention can provide the answer to your rust problem.

Use coupon below to take the first step.

magnus
CHEMICAL COMPANY INC.
11 South Ave., Garwood, N. J.

Please send FREE Rust Control Data File.

Name_____

Company_____

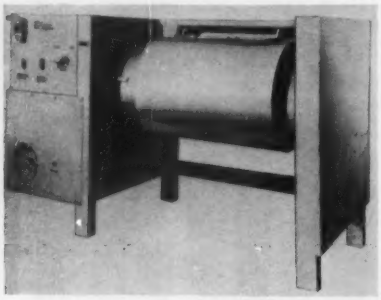
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City_____ State_____

Vibratory Finishers

Minnesota Mining and Mfg. Co., Dept. MF, 900 Bush Ave., St. Paul 6, Minn.

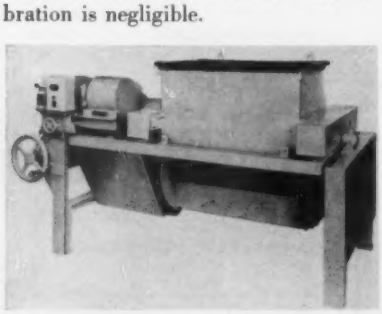


Vibrotohone finishing barrel.

The Honite Vibrotohone barrel is equipped with variable speed drive and motor to give the operator simultaneous control of frequency and degree of vibration. Vibration, rotation, and vibration with rotation are possible. This versatility permits handling many finishing jobs in sequence without reloading the barrel. Simultaneous rotation and vibration produce superfine finishes.

The unit, which has no springs, is supported by revolutionary rubber mounts. Vibration is caused by an exclusive eccentric drive principle. Because of the unique suspension and drive system, the unit is claimed to require less horsepower to operate, compared with similar equipment. The barrel is detachable.

A longer service life, plus finer finishing of a wide range of surfaces, are features of the new Vibrahone finishing tub. Rubber mounts, instead of springs, and an exclusive eccentric drive principle retain more than 98% of the generated vibrating force inside the tub, it is stated, and service life is extended because frame and floor vibration is negligible.



Vibrahone finishing tub.

The rubber lined tub is detachable and tilts for easy draining. All moving parts are guarded. A streamlined wiring design saves installation time and floor space.

Vapor Degreaser

Acra Electric Corp., Dept. MF, 9901 Pacific Ave., Franklin Park, Ill.

Reported to clean 100-125 lbs. of metal parts per hour, the Acrawatt Speedegreaser, Series D-2, is designed to operate on the principle of vaporization and condensation of the perchlorethylene solvent on greasy parts or sub-assemblies suspended in a metal mesh basket holding 50 lbs. of parts in the solvent vapors. Also, it can be used, if desired, as a convenient means for dip or immersion processing of the parts in solvent fluid before the vapor treatment.

Vapor is formed by heating 4 gallons of solvent in the 18″ diameter drum by means of a "wrap-on" electric band heater, which operates on 115



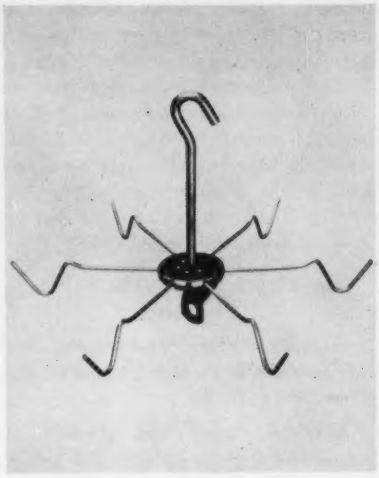
or 230 V. A.C. and is controlled by a snap-action thermostat. The heating element, thermally insulated and protected by a metal sheath, is rated at 2500 watts and gives rapid recovery.

Wire Rack

W. E. Pipkorn Mfg. Co., Dept. MF, 2211 West County Road D, St. Paul 12, Minn.

The Versitree-Six is a new, all-steel wire rack, of spider design with six "spider-leg" hooks projecting horizontally from the center staff. Hooks are made of 0.105 high-carbon spring steel wire. The center staff has a large hook at the top and an eye at the bottom for optional suspension of another rack below it.

The spider design encourages paint economy, using some of the overspray to advantage. The rack is easy to load and unload. Center staff of the rack is 6 inches long. Hooks may be ordered



in standard 4-inch or 6-inch radius or in custom lengths.

Wet Blast Unit

Pressure Blast Mfg. Co., Inc., Dept. MF, Manchester, Conn.

Measuring 50″ wide by 40″ deep by 75″ high, those areas of the Model A-45, manually-operated wet blast cabinet in contact with abrasive slurry are fabricated of stainless steel. Skirting is fabricated of galvanized metal. Two double-thickness side work loading doors provide 30″ by 30″ access to the interior of the cabinet which offers internal working area measuring 50″ wide by 36″ deep by 40″ high.

The unit 45 incorporates a heavy duty, over-rated blower for mist evacuation, large viewing window with fluorescent lighting and window wash device, elliptical armports with arm rests providing gauntlets for maximum operator comfort and freedom, knee-operated controls, and special 2-bay, caster mounted settling basin to aid in changing abrasive. The hopper, where abrasive and water are con-



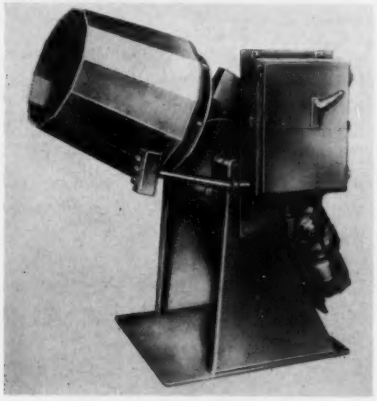
tained, is slab-sided and pyramidally shaped and features air agitation for the suspending of the abrasive in the water.

The optional Rollo Table is mounted to the left of the cabinet and bolt attached. Measuring 54" wide by 40" deep by 34" high to the top of the table, the unit incorporates inverted angle iron tracks which run into the cabinet and a plastisol-coated, expanded metal rotary table fitted on a sealed bearing, mounted in turn on a carriage with machined wheels. The area beneath the rails on the outside of the cabinet features a rinse facility.

The unit includes an exclusive high velocity blast system, as well as a regular velocity system operating on the aspiration principle. The version of the cabinet incorporating only the regular velocity system has been designated Model AA-45.

Barrel Finishing Units

Baird Machine Co., Dept. MF, 1700 Stratford Ave., Stratford, Conn.



New, improved versions of the "Electratilt" and "Hydratilt" barrel finishing units are essentially identical, possessing the same basic specifications and work capacities. The former model incorporates a manual hydraulic device for raising and lowering the barrel while the latter, as the name implies, is provided with power titling. The units tilt from 40° above the horizontal to about 35° below the horizontal.

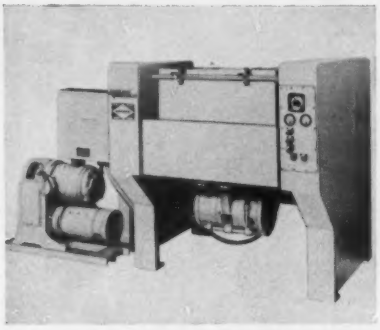
Both units require minimum floor space and feature a high degree of safety and convenience for the operator. The number of moving parts and controls has been reduced and adjustments required simplified. Both barrels can be fitted with a full range of barrels of different size, shapes and



materials, including the standard wooden barrel, cast metal barrel, bottle barrel and others. Work load capacities range from 500 lbs. to 815 lbs. dependent upon barrel selection.

Vibratory Finishers

Abrado Finish Corp., Dept. MF, 1750 Elizabeth Ave., N.W., Grand Rapids, Mich.



A new line of vibratory finishing machines manufactured by Jackson Vibrators, Inc., Ludington, Mich., has been introduced in sizes from 1/10 to 20 cu. ft. capacities.

Vibrado finishers feature full radius roll-over tub design for most effective contact area, compact cut-back housing design for space saving, full 180° tilt for easy unloading, lower overall height for loading and unloading convenience, and controlled orbital flow pattern with synchronous vibration to provide improved finishing at greatest speed. The units require no special flooring for installation, operate quietly when mounted directly to plant floor.

Polishing Belt and Wheel Lubricant

Grav-i-Flo Corp., Dept. MF, Sturgis, Mich.

Belt-Life, a new compound developed for cleaning abrasive polishing belts and wheels, contains an ingredient which extends the life of the belt or wheel by cleaning the abrasive surface, by preventing it from loading with metal, and by maintaining its high cutting efficiency. It also lubricates the abrasive surface, enabling it to produce finer finishes. Due to the faster rate of cut produced by the clean abrasive surface, it is possible to use a finer grit belt and produce a smoother surface without the use of a grease stick.

The lubricant can be applied with a brush, swab or spray while the belt or wheel is operating at normal speed. The flash point is 265°F. by closed cup test.

Plastic Caps & Plugs

S. S. White, Industrial Div., Dept. MF, 10 E. 40th St., New York 16, N. Y.

A new, General-Purpose (GP) line of plastic protectors for all threaded and non-threaded parts is available in a range from ¼" to 2¼".

Made of tough, low-cost, non-shredding elastic polyethylene, they provide complete protection to parts during shipping, storage, and manufacturing operations. The versatile new protector can be applied to machine screw threads (male and female), pipe threads (male and female), and tubing (both ID and OD).

The new plastic formulation used in the protectors is highly resistant to acids, alkalies, caustics, petroleum-based products, and most common solvents. Elastic polyethylene has excellent temperature stability from —95 to 175°F., with high dimensional stability. It has the chemical properties of conventional polyethylene, plus the additional flexibility of elastomeric vinyl. It will not affect cadimum or other plating.

Automatic Airless Spray Gun

Gray Company, Inc., Dept. MF, 1061 Sibley St. N.E., Minneapolis 13, Minn.

An automatic airless spray gun, especially designed for efficient industrial assembly line painting, the "Golden" spray gun handles a wide range of viscosities and is air-triggered for positive shut off, without leaks and spitting, whenever the air supply is released.

Its functional economy permits concentration of spray pattern from 2 to 20 inch widths. Heavy duty, easy-to-clean design makes it excellent for conveyorized finishing operations.

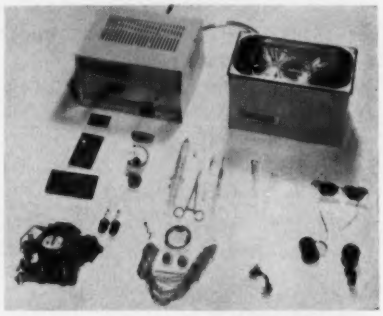


All inside parts, tips, and the screen assembly are interchangeable with those in the firm's hand gun.

Ultrasonic Cleaning Unit

Ultrasonic Industries, Inc., Dept. MF, Engineers Hill, Plainview, N. Y.

The diSONtegrator System Eighty, guaranteed for five years, features a broad band frequency modulated circuit which eliminates the need for automatic tuning as found in much higher priced equipment. The generator is rated at 120 watts average power—480 watts peak power output. Fused for 5 amp., the generator operates from 117 volt-50/60 cycle line current. A 220 volt-50/60 cycle export model is available at slight additional cost.



The 1½ gallon capacity cleaning tank features a working compartment measuring 12" long x 6" wide x 6" deep. A 9" deep tank is also available. Integral with the tank is a transducer which converts electrical energy from the generator into 90,000 cycle sound waves.

Stripper For Photo Resist

Shipley Co., Inc., Dept. MF, Walnut Park, Wellesley 81, Mass.

A new, improved cold stripper for removing photo resist from printed circuit boards and chem-milled parts, Stripper 77 works quickly, eliminates coagulation problems and offers substantial cost advantages to the user.

It softens photo resist, including KMER, KPL and KPR, until the bond is broken between the metal and the photo resist coating. The loosened resist then can be washed away with a pressure spray rinse. Coagulation problems normally caused by removed KPR Dye are eliminated because the dye is dissolved and the solution remains clear. The stripper is used at room temperature.

The stripper concentrate is diluted by adding 5 parts of a low-cost solvent. Trichloroethylene or monochlorobenzene are recommended for fastest stripping action; other solvents may be

used. The solution is not viscous. Consequently, drag-out is minimized and the solution rinses freely from printed circuit holes. Small additions of concentrate will replenish the solution for extended use.

Water-Reducible Enamels

Martin Varnish Div., U. S. Paint Co., Dept. MF, 2101 Singleton, St. Louis 3, Mo.

The new Saf-T-Enamel line is claimed to furnish a tough, flexible, adhesive film when baked at conventional baking cycles. Gloss and color are comparable to top quality conventional solvent systems, commonly used in industry today.

There is absolutely no fire hazard present since water is the only solvent used, and the coating is presently being applied on production lines by electrostatic or conventional hot or cold spray. The enamel is available in all colors, various gloss finishes and in metallics. A bronzing liquid on vehicle to be used with bronze powders is also available.

Sheet Polishing Machine

Yates-American, Dept. MF, Beloit, Wis.

Model S-101 is a high production automatic machine especially designed for producing superior finishes on



sheet type materials. The polishing operation is accomplished with an oscillating and rotating wheel-drum made of abrasive impregnated nylon. Selected grade of abrasive, variable oscillating motion of the drum, and adjustable feed rate provide the broad range of conditions with light abrasive action, to produce the most desirable precision-controlled finishes at the highest production rates and lowest costs.

The abrasive wheel-drum is posi-



To Keller Manufacturing Co., Inc., it means a savings of nearly $50 a day in finishing costs on leaf rakes. And, theirs is a comparatively small plant operation.

Before moving into their new plant, this St. Louis manufacturer of Sweep-Easy lawn and garden tools investigated and tried out various finishing equipment. They chose Ransburg No. 2 Process to do the job because they found that only the Ransburg Electrostatic Hand Gun could give them the desirable increase in production—with improved quality—and at lower cost.

PRODUCTION IS NEARLY DOUBLED
QUALITY OF FINISH IS IMPROVED

With the Ransburg Hand Gun, Keller's daily painting prodution of leaf rakes nearly doubled what they were formerly getting with air hand spray. And, where they used to get only 168 rakes per gallon of paint, they now get 426 per gallon—over 2½ times as many—actually *an increase of over* 150% *in paint mileage.* With the unique "wrap-around" feature, electrostatic is improving the quality, providing a complete, uniform coating over all areas—even on the tine edges.

NO REASON WHY YOU CAN'T DO IT, TOO!

See how the Ransburg Electrostatic Hand Gun can save time . . . paint . . . and cut costs in YOUR finishing department. Or, if your production justifies, it'll pay you to investigate Ransburg's automatic electrostatic spray painting equipment. Write for our No. 2 Process brochure which shows numerous examples of modern production painting in both large and small plants.

RANSBURG

RANSBURG Electro-Coating Corp.

Box 23122, Indianapolis 23, Indiana

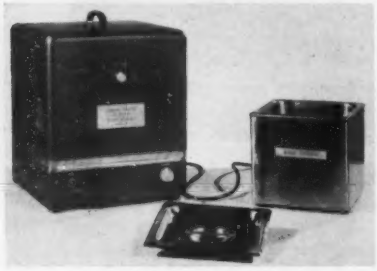
Affiliates in AUSTRALIA • AUSTRIA • BELGIUM • DENMARK • ENGLAND • FRANCE • FINLAND • GERMANY HOLLAND • ITALY • NORWAY • SPAIN • SWEDEN • BRAZIL • SOUTH AFRICA and NEW ZEALAND

tioned over the work for maximum ease of adjustment. The drum is quickly and easily removed for changing grade or renewing the abrasive. Lowering and raising of the drum by actuated air cylinder is controlled by an automatic sensing device, providing precision abrasive-to-stock contact. Oscillation of the drum is infinitely variable from 0 to 200 oscillations per minute with 3/8" lateral movement. A built in dresser makes it easy to dress the abrasive for trueing or cleaning. Feed rate ranges from 20 to 69 f.p.m. Two machine models accommodate widths of stock to 51" and 61" in thicknesses up to 3".

Ultrasonic Cleaning Unit

McKenna Labs., Dept. MF, 2503 Main St., Santa Monica, Cal.

This small cleaner is a new, low cost unit in the Poly-Sonic series, and features the special concept of several simultaneous ultrasonic frequencies. This combination of frequencies brings about a degree of cleanliness heretofore unobtainable with a single frequency only, it is claimed



The V-100 runs at 400 KC with overtones of other frequencies ranging down to 20 KC. 400 KC removes dirt particles down to 1 micron in size and penetrates into small crevices and recesses. The lower frequencies provide cleaning action required for larger dirt particles and provide cleaning on areas that are not accessible to high frequency because of shadowing.

The container is a stainless steel tank with stainless steel cover; generator and tank housings are finished in attractive blue anodized finish.

Diaphragm Pump

Edson Corp., Dept. MF, 378A S. Water St., New Bedford, Mass.

This self-priming, diaphragm pump will handle virtually any material that will flow. It readily pumps liquids containing solids of any size or shape that can pass through the two-inch suc-



tion and discharge connections. It will carry any material which does not attack the rubber diaphragm or neoprene valves. The pump is completely self-priming, has a suction lift to 25 feet. Its capacity is 1800 gallons per hour.

The working diaphragm is an extra-heavy duty 3/16" thick reinforced synthetic rubber product. Under average conditions of use, it will give between five and ten years of service. The intake and discharge valves are of neoprene, and the fittings are threaded 2" N.P.T., making it possible to connect the pump to suction hose, plastic pipe or iron pipe with standard couplings.

The light-weight lever-action pump is manufactured in aluminum, bronze and stainless steel; weighing 10½, 29½ and 37 lbs. respectively. The head ring can be rotated to locate the handle in any one of three operating positions. The handle is galvanized steel, 32 inches long and lifts out for easy storage.

The 7⅛" x 10⅛" x 17" pump is furnished in two basic models, differing only in the positioning of the inlet: either on the side or in the bottom of the base mounting.

Surface Finish Tester

Brush Instruments Division, Clevite Corp., Dept. MF, 37th and Perkins, Cleveland 14, Ohio.

A new completely portable, transistorized, battery-powered instrument for measuring surface finishes on metals, plastics, ceramics and organic materials, Model MS 1,000 Surfindicator permits precision measurements from one to 1,000 micro-inches.

A new rugged pickup stylus capable of detecting variations of ½ microinch within the measurement range contains a transducer element which generates a current proportional to surface variations. As the stylus tip is moved over a test surface, small deflections are transmitted through a viscous fluid coupler to the current generator inside the pickup. The pickup can be handheld or mechanically driven with a motor-drive unit. Minimum diameters of curved surfaces that can be checked without using a skid holder are 1/8 inch for O.D. and 5/16 inch for I.D. The stylus tip consists of a 0.005-inch radius sapphire.

Possible errors which might result from surface waviness as distinguished from roughness are eliminated by wave-length "cut-offs" which are adjustable for the particular surface under test. Three cut-off wavelengths provided for different ranges of work are 0.030, 0.010 and 0.003 inch.

Surface deviation from a mean line can be computed either by arithmetical averaging or root mean square modes in accordance with approved ASA standards. Surface finish measurements are read directly on the meter. A profile of the surface can be obtained by connecting the output to a direct writing recorder through a jack provided on the back panel.

A caliblock reference specimen with 125 and 20 microinch roughness patches is also included with the unit. The instrument is calibrated to these precision reference standards with a simple screwdriver adjustment. Overall size of the unit is 6¾ by 7½ by 5 inches. Power is supplied by two nine-volt batteries.

Polyethylene Tote Barrel

Delaware Barrel & Drum Co., Inc., Dept. MF, Box 1648R, Wilmington, Del.



A new polyethylene "tote barrel" is available in 45 gallon and 25 gallon sizes, retaining all of the desired characteristics of polyethylene. It is completely waterproof, light in weight, dent-proof and resistant to corrosion.

BUSINESS ITEMS

Stevens Appoints Brown

Frederic B. Stevens, Inc., announces the appointment of *Roger J. Brown* as a district manager. He will make his headquarters at the new office and warehouse at 597 Northland, Buffalo, N. Y.



Roger J. Brown

Mr. Brown has been a metal finishing sales representative for the firm since 1956. Prior to that time he was employed at the Detroit office as coordinator of all full automatic machine and still tank equipment sales.

He attended the University of Detroit, and during World War II, served in the U. S. Air Force.

American Buff Expands Custom-Engineering Dept.

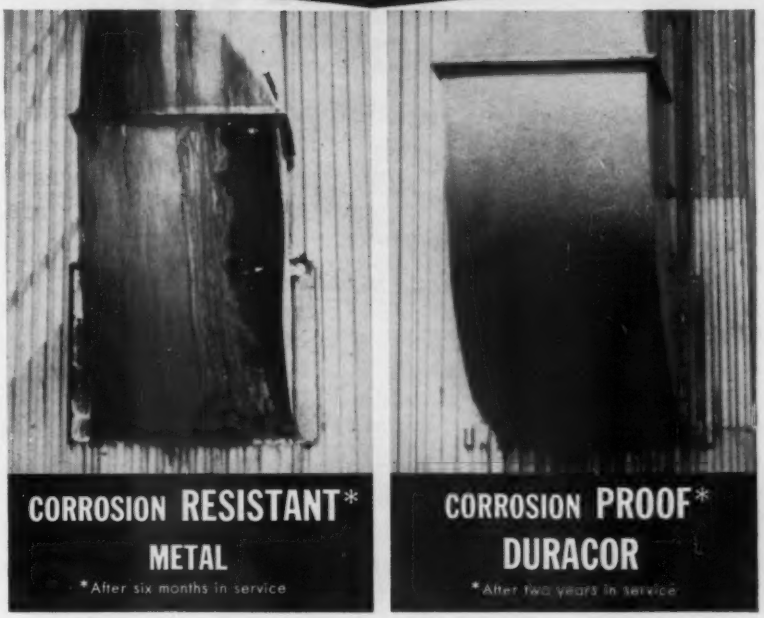
American Buff Co., Chicago, has announced the expansion of the firm's custom-engineering department, established to provide recommendations and solutions to manufacturers having special problems relating to the cutting, polishing, finishing and working of metal surfaces.

Staffed with engineers experienced in all metal finishing processes, the department is equipped with a modern machine shop, and the newest testing and analytical equipment.

Allied Research Products, Inc. Holds Sales Meeting

"Selling In A Recession" was the theme of the semi-annual Central District sales meeting of *Allied Research*

Take your choice



LIGHT, STRONG DURACOR REPELS CORROSION BETTER THAN METAL . . . LASTS LONGER . . . COSTS LESS

Duracor reinforced plastic withstands attack from almost every known solvent, alkali, reducing agent or oxidizing acid. It can be sawed, drilled, filed or sanded . . . readily fabricated into pipe, duct, tanks, hoods, and other special equipment. High resistance to heat, flame, chemicals and abrasion makes Duracor ideal for severe corrosive service in the metalworking, textile, paper, food and chemical processing industries. Duracor has a high strength/weight ratio . . . needs no exterior protection. Installation is quick, easy and economical. Duracor is fabricated exclusively by The Ceilcote Company, producers of corrosion-proofing materials for industry for more than 30 years.

CEILCOTE OFFERS DESIGN ASSISTANCE . . . BUILDS AND INSTALLS DURACOR VENTILATING SYSTEMS AND PROCESS EQUIPMENT TO CUSTOMER SPECIFICATIONS

DURACOR PROCESS EQUIPMENT

Tensile Strength p.s.i. (D638-S2T)*	11,000-15,000
Flexural Strength p.s.i. (D790-49T)*	20,000-30,000
Tensile Modulus of Elasticity p.s.i.	1.2-1.4x10⁶
Flexural Modulus of Elasticity p.s.i.	0.78-1.6-10⁶
Coefficient of Linear Expansion	9.5x10⁻⁶ in./in./°F.
†Maximum Temperature (Exposure)	500°F.

DURACOR VENTILATING EQUIPMENT

Tensile Strength p.s.i. (D638-S2T)*	8,000-12,000
Flexural Strength p.s.i. (D790-49T)*	14,000-22,000
Flexural Modulus of Elasticity p.s.i.	0.70-1.4x10⁶
Coefficient of Linear Expansion	10.5x10⁻⁶ in./in./°F.

DURACOR CEILCOTE

THE CEILCOTE COMPANY INCORPORATED
4844 Ridge Road
Cleveland 9, Ohio

Please send me your catalog of DURACOR
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☐ PROCESS EQUIPMENT
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COMPANY_____
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OVERHEAD UNDER FOOT?

precious-metal scraps, sweeps, solutions and shavings are a form of reducible overhead you may be neglecting simply because you regard them as mere shop wastes instead of the potential "buried treasure" they really are. Money hides in:

Turnings, chips, shavings	**Blanking scrap**
Anode ends	**Filter pads**
Chemicals	**Contact alloy scrap**
X-ray film	**Coated plastics, glass, etc.**
Brazing alloy scrap	**Plating solutions**
Bimetals scrap	**Platinum-bearing materials**

Once you've collected your valuable wastes from under foot, you'll want to send them where you'll get highest returns. Handy & Harman has the well-earned reputation for getting the most out of refinings, regardless of form. Try us and see. And send for our Bulletin 24—it's full of tips on *how to turn trash into cash.*

HH

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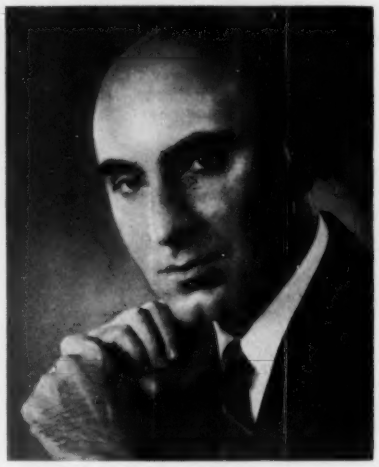
Refining Plants and Collection Stations: Bridgeport, Conn., CLearwater 9-8321 • Chicago, Ill., SEeley 3-1234 • Los Angeles, Calif., CUmberland 3-8181 • Providence, R. I., JAckson 1-4100 • CANADA: Toronto, EMpire 8-6171



Seated (l. to r.) — H. Van Buren, C. Rielly, B. Hawhee, L. Camill, District Sales Manager, J. A. Cairns, Vice-President in Charge of Sales, R. Marce, W. Gross; standing (l. to r) — R. Clement, T. Smolinski, T. Richards, J. Horner, J. Wickering, R. Sweeney, G. DeCario, W. Ohst, R. Fenwick, J. Pollack.

Products, Inc., held recently in the Detroit-Leland Hotel, Detroit, under the direction of the district sales manager, *L. J. Camill.*

Corigliano Elected President New Jersey Chapter A.I.A.



G. S. Corigliano

G. S. Corigliano, advertising and marketing manager of the Sel-Rex Corporation has been elected president of the Association of Industrial Advertisers of New Jersey.

Mr. Corigliano also teaches marketing at Rutgers University.

Free Course in Electroplating

The course of study in electroplating given at the Fort Greene Evening High School, 29 Fort Greene Place, Brooklyn 17, New York, will begin its Fall term on September 14, 1961.

The session is divided into classroom discussion and laboratory experiments. The classroom topics will include simple calculation, reading graphs, chemistry of the plating tank, pH, wetting agents, pitting, deionizing. The laboratory experiments will include solution analysis, Hull cell studies, anodizing.

Registration will be held September 6 and 7, 1961. Class sessions will commence Thursday, September 14, 6:45 P.M. Classes will meet on Tuesdays and Thursdays from 6:45 to 8:15 P.M., including about 6 Fridays. The term begins September 14 and ends January 30, 1962. Register with *Mr. L. Serota* in Rooms BW17 or 3E12.

M&T Names Orden to Latin American Operations Post

David B. Orden has been named manager of Latin American operations

for the International Division of *Metal & Thermit Corp.* In his new post, he will be responsible for the firm's overall development in the Latin American area. His headquarters will be in the company's executive offices at 100 Park Ave., New York City.



David B. Orden

Mr. Orden joined the company in 1956, when he was appointed special representative for Latin America. In 1959 he was made a director of the Mexican subsidiary, Industrias M&T de Mexico S. A., a company in Monterrey, manufacturing zirconium silicate used in the opacifying field.

Previously Mr. Orden held posts in metallurgical and chemical industries in Europe and South America. He is a graduate of the Niels Brock School of Business Administration of Copenhagen, Denmark and the Institute Superieur de Commerce of Neuchatel, Switzerland.

Barrett Chemical Appoints New Zealand Distributor

Barrett Chemical Products Co., Inc., Shelton, Conn. has announced the appointment of *Hardie Trading Co. (N. Z.) Ltd.*, Auckland, N. Z. as a distributor of the firm's sulfamate nickel plating process. Hardie has supplied and serviced the electroplating industry of New Zealand for the past 25 years.

Ultrasonic Industries Quadruples Facilities

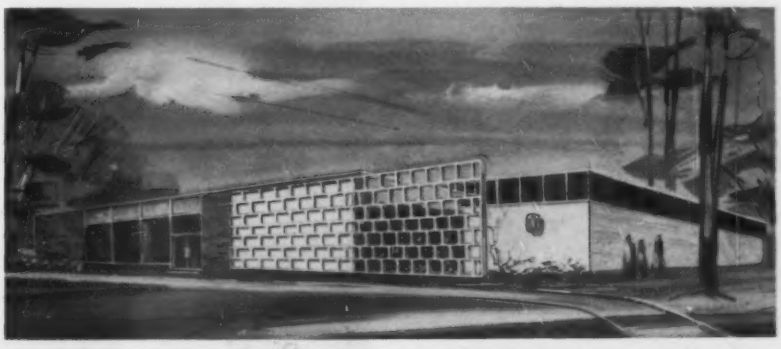
Ultrasonic Industries Inc., has relocated to Engineers Hill, Plainview, N. Y. The company's new 18,000 sq. ft. facility on two acres is quadruple the space formerly occupied in Albertson, Long Island, where it was founded in 1959.

Product: 99.75+% Pure
Service: 100% Sure



Every batch checked. Every can filled with a full weight of extra high quality 99.75+% Chromic Acid. Prompt delivery from ample factory and nearby distributor stocks. Why not order BFC Chromic Acid next time?

BETTER FINISHES & COATINGS, INC.
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National sales headquarters of the company as well as engineering and manufacturing departments are located in the new building. Robot Metalcraft Corp., a subsidiary specializing in precision sheet metal fabrication, is also integrated in the Engineers Hill operation.



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COPPER SULFATE
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TRIANGLE BRAND Copper and Nickel Sulfates help give you the hardness you need for long lasting plating. They have purity, uniformity, solubility and high conductivity. This all around dependability *does* make a difference. Therefore we suggest that you specify Triangle Brand Copper Sulfate and Triangle Brand Nickel Sulfate for all of your plating work. Send today for the free booklet "The Use of Copper Sulfate for Copper Plating."

Phelps Dodge also offers SELENIUM and TELLURIUM.

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Nadel Joins Metal Finishing Staff

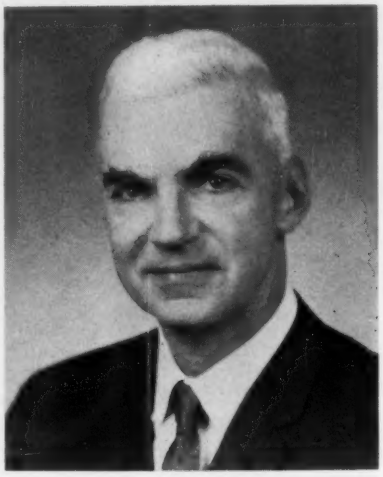
The publishers announce that *Eugene B. Nadel* has recently joined the advertising staff of METAL FINISHING. He was previously associated with the G. M. Basford Advertising Agency in New York and, prior to that, had held summer employment in the laboratory of the Udylite Corp., Woodside, L. I., N. Y. and the Vernon Plating Works, a subsidiary of Dejur-Amsco Corp., also of Woodside. Mr. Nadel is a resident of Queens, N. Y. and studied at the University of Rochester and Queens College, Flushing, N. Y., from which he graduated in 1959 with a B. A. degree in economics. More recently he attended the DeVilbiss School of spray painting in Toledo, Ohio. He is also affiliated with the 244th Nike Ajax Missile Unit of the National Guard.



Eugene B. Nadel

O'Brien Joins Hubbard-Hall

Harold J. O'Brien of Cranford, N. J. has joined the staff of *Hubbard-Hall Chemical Co.*, Waterbury, Conn. as a metal finishing technical representative. He will serve accounts throughout New Jersey with a complete line of metal cleaners, buffing and burnishing compounds, strippers, metal specialties, anodes and finishing equipment. Mr. O'Brien comes to the company from the Udylite Corp., where he was New Jersey sales representative for ten years. Before that he had been in charge of plating and quality control at the Brunswick Corp. of New York. Mr. O'Brien belongs to several professional societies including the Newark Branch of the A.E.S.



Harold J. O'Brien

Tuttle Named Diversey Division Manager

C. E. Tuttle has been named manager of *The Diversey Corp.'s* Southwestern Division. He will supervise sales and sales promotion activities in all of Texas and New Mexico and in southwestern Colorado. He joined the company in 1945 and had been a district manager since 1950.

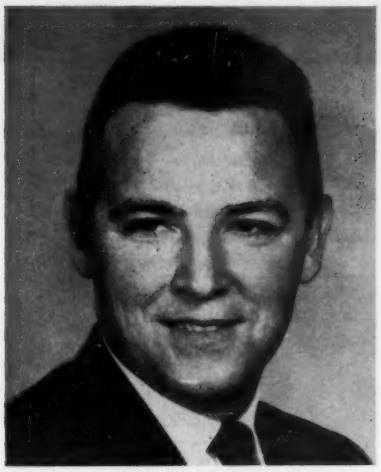
Voltmann Appointed by MacDermid, Inc.

Robert Voltmann has been appointed product development manager by *MacDermid Incorporated*, Waterbury, Conn., manufacturer of metal cleaning, plating and finishing chemicals. He has been assigned to the company's

research laboratory in the Waterbury plant.

Mr. Voltmann previously was employed for twelve years by Chrysler Corp. as a laboratory supervisor and a project engineer.

Mr. Voltmann is the author of numerous technical reports on metal finishing subjects, many prepared while



Robert Voltmann

working in the Inorganic Finishing Laboratory at Chrysler. He has also disclosed ten ideas to the Patent Office, ranging from a new type high-voltage thickness tester to a new immersion nickel process.

A former resident of Pontiac, Michigan and graduate of Wayne State University, Mr. Voltmann served during World War II as a Lt. j.g. aboard the U.S.S. Currier as engineering officer. He is a member of the American Electroplaters' Society.

Michigan Chrome Acquires Allied Research & Engineering

Michigan Chrome and Chemical Co., Detroit, announces the acquisition of *Allied Research & Engineering Co.* of Hollywood, Calif., a leader in the new technology of electroforming. The latter will continue in this field, adding other services as customer requirements expand.

Paul Harper, formerly west coast district manager for the Chemical Division of the parent company, has been promoted to general manager of Allied, which will operate as a wholly owned subsidiary.

Appointments at Deering Milliken

Deering Milliken, Inc. announces the appointment of *Earle R. Loomer, Jr.*,

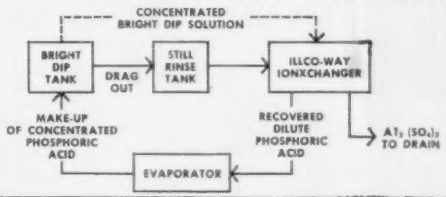
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ILLCO-WAY ionXchange

SPECIALIZED EXPERIENCE SHOWS HOW TO SAVE MONEY

The use of ion-exchange eliminates the need for dumping expensive phosphoric acid. Four years of successful experience in recovery of bright dip solutions enables us to make several recommendations, depending on particular conditions. Usually, we employ a cation exchanger to purify the first rinse, recovering phosphoric acid which has been carried over from the bath by dragout. Another treatment removes aluminum direct from the bath. The use of IWT ionXchange can not only improve the uniformity of your product through better quality control in the plating, but also can be a very *profitable* investment.

PROCESS CAN BE USED IN SEVERAL WAYS



The block diagram at the left illustrates the general methods of treatment suggested above. Actually, every installation presents its own special problems — which IWT engineers are well-equipped to solve. *So, consult your IWT representative for specific suggestions.*

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NEW YORK OFFICE: 141 E. 44th St., New York 17, N.Y.
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Armand A. Durante, Jr.

to the newly created position of merchandise manager, Carded Cotton Division. Mr. Loomer's activities will be concentrated on the development of new products, new market areas and long range planning for the mills of the division.

Armand R. Durante, Jr., former manager of the Cleveland sales office, replaces Mr. Loomer as market manager, General Industrial Fabrics Dept., and will be responsible for sales of industrial carded cotton fabrics, including buff wheel fabrics.

Levco Metal Finishers Expands

Levco Metal Finishers has announced expanded facilities by enlarging its jobbing operations through its subsid-



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SYNTHETIC PEARL ESSENCE

Formulated for use with practically all coating vehicles... for application by almost any coating method, Nacromer transforms ordinary coating materials into eye-catching "sales-feature" finishes.

Coating users, on the alert for something different to make their products stand out, will be interested in Nacromer coatings because they are different . . . because they add unusual beauty . . and, because they're easy to use.

If you are looking for a new distinctive finish, why not try Nacromer?

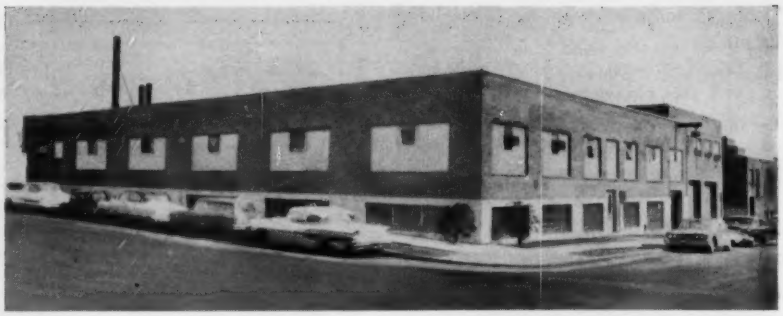


NEW 8-PAGE HANDBOOK

Our new 8-page Nacreous Pigment Handbook and 4-page, "Coating with Nacreous Pigments" brochure contain much valuable information on the use of Nacromer. Write for your copies today.

THE MEARL CORPORATION

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iary, *Levco Automatics*. With one plant operating at capacity in Astoria, N. Y., it has added another 30,000 sq. ft. in a new plant in Woodside, N. Y. for full automatic copper, nickel, chrome, and brass plating. *Milton Nadel*, general manager, will assume charge and will coordinate operations within the two plants. It is stated that additional machines for wire plating and strip anodizing will be installed within a short time in the new plant.

Kelley Named Director of Diversey Research Labs.

The appointment of *Dr. Maurice J. Kelley* as director of research laboratories has been announced by *The Diversey Corp.* Before joining the firm he had served as director of the project coordination department and director of industrial specialists laboratories of Nopco Chem. Co., Harrison, N. J. He joined Nopco in 1936 as research chemist in the synthetic organic laboratory.

Dr. Kelley earned the degree of doctor of philosophy in organic chemistry in 1942 at the University of Pennsylvania. He also holds an M.S. degree in organic chemistry from Fordham University and an A.B. in chemistry from LaSalle College. Since 1959 he has done additional graduate work in management and marketing at the Graduate School of Business Administration, New York University.

Dr. Kelley is a fellow of the American Institute of Chemists, former chairman of the New York Chapter of AIC, and a member of the American Chemical Society, American Association for the Advancement of Science, The Chemical Society (London), and several other professional organizations. In 1959 he received the Honor Scroll of the New York Chapter of the American Institute of Chemists.

Allied Research Appoints Ostrander

It has been announced by *Allied Research Products, Inc.*, Baltimore, that *Charles W. Ostrander* has been appointed to the post of technical assistant to the president. He has been associated with the firm since its inception in 1941, and his most recent



Dr. Maurice J. Kelley



Charles W. Ostrander

position prior to his promotion was technical director.

Mr. Ostrander is well known in many technical societies, including the American Electroplaters' Society, and is the author of a number of papers delivered before various A.E.S. and other groups.

Laitsch Joins Conforming Matrix

Charles Edlund ("Chuck") Laitsch, for ten years metallurgist and manager of engineering of Grand Rapids Brass Co., has been appointed representative of *Conforming Matrix Corp.* for Western and Northern Michigan.

Laitsch, who has an extensive background in the painting of die castings, stampings and injection and vacuum molded products, has been identified



Charles E. Laitsch

with the activities of American Society for Metals, Society of Diecasting Engineers, and American Society for Testing Materials.

James Case, former vice-president and manager of Deco Tools, Inc., has also joined the sales and service staff.

Mr. Case was one of the firm's early employees, and was subsequently with the industrial finishing departments of Aluminum Model Toy of Detroit and H. A. Silverstone of California.

Scholarship Program for Graduate Study

A new research scholarship program, providing engineers with the opportunity for graduate study in metal cleaning operations and processes, was announced recently by its joint sponsors, *Phillips Mfg. Co.* of Chicago, manufacturer of metal cleaning equipment, and *Diamond Alkali Co.* of Cleveland, a leading producer of chlorinated solvents and chemical products.

The scholarship will be awarded on a yearly basis, and will provide special funds and assistance for research study at the University of Pittsburgh. Long active in internal and external research programs, the two firms will continue the scholarship fund indefinitely to complete a long range investigation of degreasing equipment, solvents and methods; the chemical and physical changes occurring to chlorinated solvents, perchlorethylene and trichlorethylene, during the actual degreasing process with periodic reports on case histories of the more interesting and complex problems.

The first year's scholarship was awarded to *Richard C. Fullerton.*



Richard C. Fullerton

Mr. Fullerton received his B. A. in Chemistry from Kenyon College, and served with the United States Air Force in Japan.

Diamond Alkali Co. Promotes Everson

Promotion of *Howard E. Everson* to director of research, *Diamond Alkali Co.,* was announced recently. He will succeed *Thornton F. Holder,* who died last month.

Assistant director of research since 1958, Everson joined the firm in 1951 as a senior chemist in research. Subsequently, he was responsible for other important research assignments until 1956, when he was transferred to the Central Engineering Department in Cleveland as a senior engineer.

Prior to joining the company, Everson served three years on the faculty of the University of Cincinnati as an assistant professor of chemistry. He was also employed by a prominent

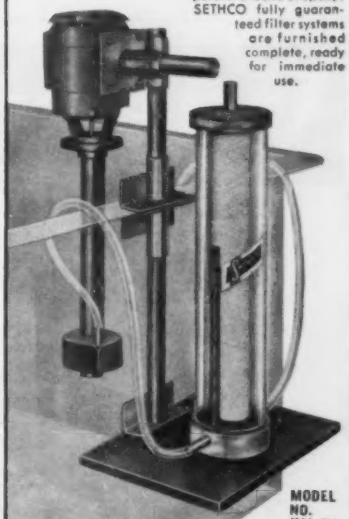
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offers universal, self-priming, maintenance-free, leakproof operation

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SETHCO 'In-Tank' epoxy pumps are rugged and chemical resistant. They are available with Type #316 S.S., Hastelloy, titanium or epoxy glass pump shafts. Filter chambers are high temperature lucite or epoxy. SETHCO fully guaranteed filter systems are furnished complete, ready for immediate use.



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chemical producer in inorganic research.

Everson is a graduate of Western Reserve University with B. A. and M. S. degrees in chemistry. In 1948, he earned his doctorate. He is a member of the American Chemical Society, the Chemist's Club, Sigma Xi, Phi Lambda Upsilon and Alpha Chi Sigma. During World War II, Everson served as a captain in the U. S. Marine Corps for four years.

Barrett Chemical Appoints Distributor

Barrett Chemical Products Co., Inc., Shelton, Conn., has announced the appointment of *W. M. Fotheringham, Inc.*, 975-81 Niagara St., Buffalo, N. Y. as a non-exclusive distributor of its sulfamate nickel plating process.

Supreme Court Upholds Ransburg

The Supreme Court of the United States has upheld Ransburg in the case of *Binks Mfg. Co.* vs. *Ransburg Electro-Coating Corp.*

After granting Binks a writ of certiorari (the calling up of the record from the Court of Appeals for review) to consider four questions relating to alleged patent misuse and violation of the anti-trust laws and, after hearing oral argument and fully examining the record, the Supreme Court concluded unanimously that the record did not warrant bringing the case before it and, accordingly, dismissed the writ.

By its decision, the Supreme Court refused to disturb the decision of the Court of Appeals for the 7th Circuit in Chicago, which had previously affirmed the decision of the Honorable Cale J. Holder, Judge of the U. S. District Court for the Southern District of Indiana. Judge Holder held valid two basic patents on the Ransburg No. 2 Electro-Spray Process, enjoined Binks from infringing these patents, and rejected Binks' charges against Ransburg of patent misuse, violation of the anti-trust laws and unfair competition.

New Company Formed

Announcement has been made of the formation of *Products Finishing Supplies, Inc.*, which will manufacture and distribute supplies and processes to the plating, polishing, buffing, and allied fields. The firm will act as distributor for Federated Metals Div., Midwest Buff Mfg., Roberts Rouge Co., Armour Coated Abrasives, and other well known firms in this field. They will carry complete stocks locally and will have laboratory and engineering services available.

Elmer Lundberg was named president and general manager. He is a graduate of Purdue University and a past-president of the Indianapolis Branch of the A.E.S. He has had twenty years experience in every phase of the metal finishing field.

The firm is located at 2069 Martindale Ave., Indianapolis, Ind.

Personnel Changes at DuBois

Three new appointments have been made at the Cincinnati plant of *DuBois Chemicals, Inc.*; *Leonard Westenberg* to manager of the Equipment Division; *Robert Nieporte* to assistant plant manager; and *Roger Arnold* to head of the control laboratory.

Mr. Westenberg was formerly assistant manager of the Cincinnati plant. He joined the company in 1955 in the Traffic Department and has also served

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Call for Formax Sisal Buffs when you have need for a fast cutting, heavy duty wheel to refine surface imperfections that are too deep for cloth buffs to remove. You will find they serve excellently to blend and smooth stretcher strains, orange peel, light die marks and polishing wheel grit lines. And—at the same time leave a bright surface finish.

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"THE FOUR McALEERS"

Formax Buffs manufactured in Canada by:
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as assistant to the purchasing agent.

Mr. Nieporte was formerly head of the control laboratory of the Cincinnati plant. He joined the company in 1955 as a co-op student from the University of Cincinnati and has also served as a lab technician.

Mr. Arnold has been serving as a chemist since joining the firm in 1958.

Cowles Moves to New Location

Cowles Chemical Co., manufacturer of industrial chemicals, has moved into the Cowles Chemical Bldg., 12000 Shaker Blvd., Cleveland 20, Ohio.

The move, after twenty years in the firm's general offices, is part of the over-all expansion program which started with the purchase of Poor & Co.'s Promat Div. last year.

Shipley Opens New West Coast Office

Shipley Co., Inc., of Wellesley, Mass., has opened a new and larger West Coast sales and technical service office at 6399 Wilshire Blvd., Los Angeles 48, Cal.

The company will continue to maintain its Los Angeles warehouse.

Manufacturers' Literature

Cleaning Products

Wyandotte Chemicals, J. B. Ford Div., Dept. MF, Wyandotte, Mich.

Cleaning products for aircraft modification, maintenance and manufacture are detailed in a colorful 6-page folder. Included are products for aluminum, magnesium, and steel cleaning, spray booth maintenance, aluminum brightening, carbon removal, cleaning of aircraft exterior, exhaust stain removal, integral fuel tank descaling, paint strippers. The folder is illustrated with photographs of cleaning processes as well as the firm's research and manufacturing facilities.

Barrel Finishing

Roto-Finish Co., Dept. MF, 3700 Milham Road, Kalamazoo, Mich.

Problems in the selection of the right abrasive media and compounds for use in vibratory and barrel finishing, are discussed in a new 3 color catalog, which illustrates a wide variety of media types for mechanical finishing operations such as grinding, deburring, descaling, polishing, brite-honing and burnishing.

Stainless Steel Valves

Cooper Alloy Corp., Valve & Fitting Div., Dept. MF, Hillside, N. J.

A 132-page illustrated catalog covers a complete line of stainless steel valves and accessories. Included are ball, gate, globe, check, angle, "Y," sampling, tank, and needle valves, and accessories.

Valves are shown in a wide range of types, sizes, end connections, and temperature and pressure ratings. The catalog covers design features, special operating mechanisms, materials of construction, principal dimensions, and cross-section drawings.

Metal Treatment

MacDermid Inc., Dept. MF, Waterbury 20, Conn.

A new metal stripping selector, which indicates the recommended



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Fast, low cost finish for aluminum, copper and alloys, steel and stainless steel. Ideal for decorative finishes, burr removal, electroplate adhesion and size control. Standard and custom concentrates nationally available in any quantity.

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A series of ads presenting
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product for stripping various metals from a wide range of basis metals and alloys, lists a directory of 22 different strippers by the complete product name, the matching technical data sheet number, and with a brief description of the product and its uses and advantages.

Metex M-662, a new dry acid salt which deoxidizes aluminum alloys for phosphating, anodizing, painting, plating or bright dipping in one safe, fast operation is fully described in Technical Data Sheet No. 117.

Silver Stripper CB, a new acid solution for stripping silver from copper, brass and other copper alloys by immersion is fully described in Technical Data Sheet No. 127.

Adjustable Pressure Switches

Pall Corp., Dept. MF, 30 Sea Cliff Ave., Glen Cove, N. Y.

Bulletin E8 includes photographs and drawings of a leak-proof, adjustable pressure and differential pressure switch for use in fluid systems operating at up to 250 psi, together with a description of its construction and operation, optional variations and available accessories. The bulletin also contains data on applications, porting, and the wide variety of fluids with which these switches may be used.

Rustproofing Prior to Painting

International Rustproof Corp., Dept. MF, 1061 E. 260th St., Cleveland 32, Ohio.

A new four-page illustrated folder on Meta Bond, a production line system for creating zinc phosphate rustproofing on metal products prior to painting, describes and illustrates the micro-crystalline nature of the Meta Bond protection, and compares degrees of protection afforded by this system in contrast to other commercial metal conversion coating systems.

Metal Cleaning & Processing

Turco Products, Inc., Dept. MF, 24600 S. Main St., Wilmington, Calif.

A new, comprehensive 12-page illustrated booklet contains specific information for the use of each of the 43 products that make up the company's standard line of cleaning and processing compounds for the metalworking industry.

Among the chemical processes discussed in the brochure are: cleaning, phosphating, conversion coatings, protective coatings, paint and carbon removal, descaling, rust removal and prevention, inspection, processing aluminum and maintaining paint department and other plant areas.

Wetting Agents

Nopco Chem. Co., Inc., Dept. MF, 60 Park Pl., Newark 1, N. J.

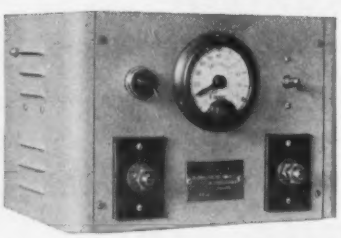
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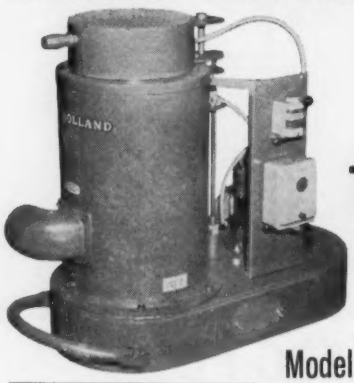
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NEWS FROM CALIFORNIA



A. D. Perkins, president, Alert Supply Co., Los Angeles, has announced ground was broken recently to initiate construction on a new $250,000 plant at Paramount Boulevard and Rex Road in Pico-Rivera, Calif. The new plant will be situated on a 2¼ acre tract approximately 12 miles east of downtown Los Angeles. It will contain 75,000 sq. ft. of floor area for offices, warehousing, and manufacturing purposes, and will provide the firm with 90% more space than is available at the present plant.

This will be the fourth plant occupied by the company since it was organized in 1950 by Perkins and *A. D. Gaskin*. Present officers are Perkins, president; *Kim Jung*, secretary-treasurer; and *Paul Waalsco*, vice-president and sales manager. Gaskin retired in 1960.

James M. Sowell has been promoted from Los Angeles manager to Pacific Coast manager of the Federated Metals Division of American Smelting and Refining Co. In the new post, Sowell has jurisdiction over the firm's interests in the eleven western states. His headquarters will continue to be at the Los Angeles offices, 4010 E. 26th St.

Harold Lever, president MacDermid, Inc., Waterbury, Conn., was a visitor to California in April for conferences with *Claude Weekly*, the firm's West Coast manager, and visits to Southern California plating shops.

Another visitor from New England was *Lawrence J. Durney* of Enthone, Inc., New Haven, Conn. Mr. Furney addressed Los Angeles Branch, A.E.S., on "Electropolishing" on April 8, and Portland, Ore., branch on the same subject on April 13.

Edwin C. Rinker of the Sel-Rex Corp., Nutley, N. J., conducted a symposium at Motorola, Inc., in Phoenix, Arizona, on April 11 on the subject of high purity gold applications in semi-conductors. The previous Saturday he had addressed Los Angeles Branch, A.E.S., on space age precious metal plating.

Harry Steinke, an engineer affiliated with Electrolab Printed Electronics in Encinitas, Calif., has advised METAL FINISHING that the new San Diego Branch of the A.E.S. has elected its first officers, who are as follows:

President, *Harry Steinke;* vice-president and educational chairman, *George Locke*, Colonial Silver Co.; treasurer, *Stanley Townsend*, Langley Corp.; secretary, *Walter Dorenbusch*, Braun Corp., San Diego. The board of managers is composed of *Nick Carter* of Ultrasonics Systems Corp., and *Richard De Laner*, San Diego Plating Co.

The new branch was to be officially presented with its charter on May 20 with *John P. Nichols*, executive secretary, and *Chester Borland*, national first vice-president, representing the Supreme Society, and with a group of

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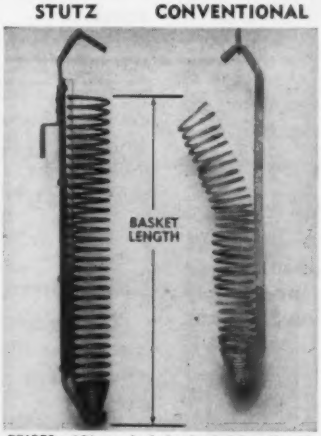
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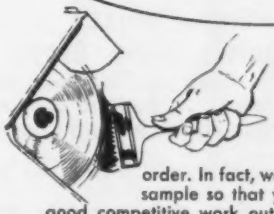
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Los Angeles officers and members, headed by President *Emmett H. Babcock*, in attendance.

W. A. McCune, grinding wheel sales manager of the Norton Co., Worcester, Mass., *Peter Marshall*, assistant director of personnel, *W. C. Howard*, supervisor of distributor sales promotion, and *E. L. Sinclair*, chief product engineer, were among Norton home office executives who recently directed a week-long abrasive training course at the Sheraton-Palace Hotel in San Francisco.

Also participating in the program were *Sidney Weatherhead*, the firm's West Coast manager, and *L. I. Smith*, *John Clark* and *T. Z. Richards*. In attendance were distributor salesmen from California, Arizona, Oregon, Utah and Washington. The conference culminated in a tour of the company plant in Santa Clara, Calif.

Dr. W. J. Remington of the Elastomer Chemicals Dept., Du Pont Co., discussed the basic elements of urethane coatings in a talk at the last monthly meeting of the Los Angeles Society for Coating Technology.

The program, devoted exclusively to polyurethanes, drew a near record attendance of 216 members and guests to the meeting.

Metal & Thermit Corp., Rahway, N. J., has named the Victor Equipment Co. of San Francisco as a distributor in Southern California. The Victor organization will sell and service the manufacturer's line through four sales outlets in Southern California, and also in northern California.

Paul A. Waalkes, who earlier this year was named sales manager of Alert Supply Co., Los Angeles, has been elected vice-president and director. Alert, a subsidiary of Hanson-Van Winkle-Munning Company, maintains offices and manufacturing facilities in Los Angeles, and offices and warehouse in San Francisco.

Harold C. Wells reports that he has severed his connection with Crown Chemical & Engineering Co., Los Angeles and established his own firm. He operates under the firm name of H. C. Wells Co. with offices and plant at 5300 E. Beverly Blvd., Los Angeles. Wells announced that he will engage in the design and manufacture of plating machinery and shop equipment, including rectifiers and other D.C. power units, and will also handle compounded industrial chemicals, conversion coatings, additives, and other shop supplies.

Wells, along with *Tom Turner* and *Jack Bealle*, all formerly employees of the A. J. Lynch Co. in Los Angeles, founded Crown Chemical & Engineering Co. in 1952. Wells was vice president of sales and engineering.

Vitro Chemical Co., Salt Lake City, Utah, has named *James D. Moore* as manager of its western operations. He will headquarter in Salt Lake City.



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Phoenix Branch

The May Meeting was held at the Arizona Ranch House Inn at 5614 North Central Ave., with 18 members and guests present. After a baked ham dinner, *Floyd Huhn*, president, called the meeting to order. Guests present were *Seymour B. Lonyai* of Fidelity Chemical Products Corp., *Dee McDermid* of Behr-Manning Co., and *Don Porter* and *Robert Bentley* of G.E.

The motion was made and unanimously passed that a letter be written recommending that a committee be appointed by the national organization to investigate and recommend the rewriting of government specifications as recommended by the Waterbury Branch.

It was unanimously agreed that the Phoenix Branch would support the Dallas-Ft. Worth Branch in its efforts to obtain the National Convention in 1967.

The election of officers for the coming year was held with the following results:

President, *James Weaver;* first vice-president, *John Mularkey;* second vice-president, *Paul Wible;* secretary, *Ron Dezember;* treasurer, *Al Espinosa;* librarian, *Bill Bath;* board of managers, *Floyd Huhn, David Rodriguez, Roger Scarborugh.*

Paul M. Wible,
Secretary

Southeastern Branch

The Branch held its regular monthly meeting at the Pig-N-Whistle Restaurant on May 12, *Myron M. Randman* presiding.

The highlight of the evening was the installation of new officers: president, *Vince Cashen;* 1st vice-president, *Jerry LaChappelle;* 2nd vice-president, *Roy Peterson;* librarian, *John Varner;* secretary-treasurer, *H. R. Stogner, Sr.*

Mr. Cashen spoke briefly, promising many innovations in branch leadership and expressing a determination to work hard towards more interesting meetings and larger attendance.

Clem Hohner was appointed chairman of the Annual Ladies Night to be

held sometime in August at the Druid Hills Country Club.

Robert H. Probert, newly appointed Dixie Region General Chairman announced the selection and cooperative acceptance of the 1962 Dixie Region Committee: program, *Pat Millikin;* entertainment, *Clem Hohner;* plant tour, *Claude Nalley;* education, *John Varner;* secretary, *H. R. Stogner;* publicity, *J. LaChappelle;* registration. *Bob Rutledge, Carl Sweet;* Ladies, *Mrs. H. R. Stogner, Sr.*

At a later date publicity chairman from each branch will be appointed to assist Mr. LaChappelle.

Robert H. Probert,
Assistant Secretary

Waterbury Branch

The Branch held its regular meeting at the Roger Smith Elton Hotel on May 11. This meeting was designated "Old Timers Night." Many of the retired members from the Branch returned for the occasion. The business portion of the meeting was featured by the election of next year's officers. The newly elected officers are:

Louis Porretti — President; *Patrick Mazzamaro* — 1st Vice-president; *Francis Schneiders* — 2nd Vice-president; *James Kennedy* — Secy.-treas.; *Clarence Foster* — Librarian; *Frank Tirendi* — Delegate; *William Giesker* — Delegate; *Francis Schneiders* — Delegate; *Michael Orient* — Alt. Del.; *William Innes* — Alt. Del.; *Martin Sternfels* — Alt. Del.

It was reported that the 22nd New England Regional Meeting held in Hartford on April 22nd was the biggest yet, with over 900 tickets sold and over 838 attending the dinner.

Dr. George Dubpernell was introduced by Technical Chairman *Patrick Mazzamaro.* The topic was "What's New in Metal Finishing," and it was demonstrated 78 times that a lot was new in the finishing field. Dr. Dubpernell brought a segment of his library to the meeting and reviewed many of the books.

Refreshments were served after the meeting. There will be no more meetings of the Branch until September 14.

F. A. Schneiders,
Publicity

Rockford Branch

More than 85 members and guests of the Branch gathered at the Faust Hotel, in this city, on May 8th to pay their respects to *Nick Servatius,* founder of Modern Plating Co., Freeport, Ill., with a testimonial dinner in his honor. Dispensing with all regular branch business, this Nick Servatius Night was one of the best kept secrets since the atom bomb.

Mr. Servatius was brought to Rockford from his home in Freeport, by *Father Arthur O'Niel,* pastor of St. Thomas Aquinas Church of that city, under the pretext of visiting the Bishop and was taken completely by surprise when he was ushered into the special dining room, where the assembled branch greeted him by singing "For He's a Jolly Good Fellow." With moist eyes and choked up voice, Nick announced that, while he had come to kiss the Bishop's ring, he now wanted to kiss his friends.

After President *Harold Ellis* welcomed Nick, he introduced the members of his party which consisted of *Fr. O'Niel, Richie Servatius,* his son, *Cliff Stearns,* superintendent of Modern Plating and its first employee, and *Rudy Hazucha* of the Clinton Co., one of Nick's closest friends who sponsored him for American citizenship.

Photos of Modern Plating Company, showing their vast and specialized equipment were shown, together with pictures of Nick's new home. Following the showing of these pictures, President Ellis turned the meeting over to *William "Bill" Giesmann* who acted as master of ceremonies.



Cliff Stearns (top left) Supt. of Modern Plating, Fr. Arthur O'Niel, pastor St. Thomas Aquinas Church, Freeport, Ill. (rear center) and Richie Servatius (rear right) look on as Harold Ellis, President of Rockford branch A.E.S. presents a "This Is Your Life" type book to Nick Servatius (lower right) at a branch testimonial dinner on the 25th Anniversary of Modern Plating Co., Freeport, Ill., which Nick founded.

A framed plaque commemorating the occasion was presented to Nick by Mr. Ellis, who then turned the meeting over to the guest of honor, who not only expressed thanks but regaled the audience with many hilarious stories of his early days in the metal finishing industry.

Since all branch business had been put aside for the occasion, President Ellis announced, before adjourning the meeting, that the June meeting would

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*4.8-5.2 pH	7.3- 8.7 pH
*3.6-5.0 pH	8.6-10.0 pH
*2.4-3.9 pH	10.1-11.3 pH
1.0-2.8 pH	10.5-13.0 pH
0.4-1.4 pH	11.0-13.1 pH

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be one of great importance since the delegates to the National Convention must be instructed and many branch matters must be decided. After the formalities were brought to a close those present extended their personal good wishes to the guest of honor.

Alexander Alexander,
Publicity Chairman

Rochester Branch

The May 1st meeting was called to order at the Rochester German Club by President *John Cipolla.* There was no speaker, as the main part of the meeting was devoted to making final preparations for the Branch's 50th Anniversary meeting and Regional Conference which was held at the Hotel Manger on May 5th and 6th.

It was decided that the branch would hold their final meeting on June 5th at the Rochester Red Men's Club with a smorgasbord dinner. Election of officers will take place at this meeting.

Peter VanDilst,
Secretary

Newark Branch

President *Al Korbelak* called the meeting to order at 8:35 p.m. with 70 members and guests in attendance. *Steve Batiste* of International Wire Co. was elected to membership. *William Duggins* transferred to the Los Angeles Branch.

The secretary announced that headquarters is seeking a dues increase, and that two branches, namely Lancaster and New York, were opposed to granting an increase. Since this is a rather involved matter, it was tabled for the next meeting of the executive committee.

Cy LaManna then was called upon to present the awards to the men who completed the electroplating course. He was assisted by both Korbelak and Foulke. Mr. LaManna then publicly thanked the people and the organizations which made the course possible.

Gene Wagner, the new librarian, then presented *James Lind,* who gave the timely topic. Jim explained in detail how Weston Instruments plated Alnico #5 alloy and an iron-lead alloy mainly for solderability.

Milton Nadel then spoke on the "Hard Coating of Aluminum."

A lively question and answer period kept both speakers busy. Both were given a rising vote of thanks and the meeting adjourned at 10:45 p.m.

Gustav Bittrich,
Assistant Secretary

New York Branch

President *Jack Weiner* called the meeting to order at 8:30 P.M. with all officers present, on May 26, at the Hotel Statler. A motion made and carried that application for membership from *Laurence Eccler* follow regular course. Following recommendations of board of managers, *Anthony Ciccotilli, Thomas A. Babbin, George A. Miller* and *B. N. Francis* were accepted as members and duly sworn by Mr. Weiner.

The board of managers recommended $300 be allotted for expenses of three delegates to convention at Boston. The board also informed the members that the by-laws, as corrected by committee headed by *Sol Ader,* are being printed and will be mailed to all members of the Branch.

Librarian *Walter Schwartz* introduced *Philip C. Rech* of Pennsalt Chemicals Co., who spoke on the "Hinac Process." Mr. Rech covered the application methods for the coatings.

Following the question and answer period, Mr. Rech received a round of applause from the members in appreciation for his introduction to these new ways of finishing metals.

Fred Saras,
Recording Secretary

Los Angeles Branch

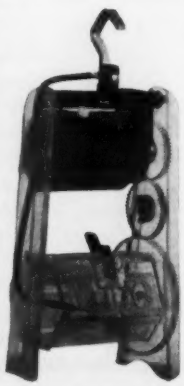
Robert Mintz, printed circuit technical specialist for Wildberg Bros. Smelting & Refining Co.'s Los Angeles office, presented a talk on "Trouble Shooting in Printed Circuit Plating" as the feature of the educational session of the Branch on the night of May 10. A lengthy question - and - answer period was conducted by *Don Baudrand* after the completion of the formal talk.

After a lapse of several years, *Earl Coffin* again served as master-of-ceremonies involving the installation of new officers, headed by President *Emmett H. Babcock* of Pomona, Calif. Outgoing president *Frank Virgil* and his associate officers for the 1960-61 term were given a vote of thanks, and Virgil was presented with a clock-radio in appreciation of his efforts during a term which included preparations for the national convention in June, 1960. Virgil was then presented with a pin emblematic of his initiation into the Past-President's Club, with *Truman Stoner* making the presentation.

As his final chore as the 1960-61 membership chairman, Babcock gave a report on membership, revealing that the branch had managed to maintain its membership total around the 300 mark despite the business depression which, to some extent, retarded activity in the plating field.



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Don Baudrand, last year's educational chairman, gave a financial report on the Plater's Handbook issued by the branch in 1960. He presented the treasurer with a check in the amount of $896.16, representing profit the branch made on publishing the book. Two thousand copies were printed, approximately 70% distributed so far, with a stock of about 600 copies on hand and available to anyone interested in a technical platers' volume of that type.

Robert Jones, of L. H. Butcher Co., was named sergeant-at-arms. Other non-elective posts were filled by reappointment of *Bert Adams* as publicity chairman, *Wilber G. Lidke* as chairman of the research committee, and *William Pardee* and *Dan Ross* as assistants to this year's educational committee chairman, *Gene Bozzelle*.

Applications for membership were accepted from *John H. Jones, G. F. Bohnin, Thomas H. Allan* and *Charles R. Thomas*. Sergeant-at-arms Jones introduced the following guests: *Bruce Wilson*, Graphic Circuits; *James Davidson*, Convair, Inc.; *Dorothy Terrill*, Prudential Insurance Co.; *C. T. Myers*, Nortronics, Inc., *Herbert Pflugren*, Santa Ana Photo Circuits; and *E. Leroy Sabel*, Allied Research Products.

Dayton Branch

The Branch held a dinner meeting on May 17 at Kuntz's Cafeteria with 29 members and guests present. During the business meeting, *Al Wendt*, treasurer, reported on the financial condition of the Branch. *Walter Anderson*, Tri-State representative, reported on tentative plans for a panel discussion to be held next fall in Cincinnati.

The following officers were elected for the coming year: president, *Lawrence H. Hadlock;* 1st vice-president, *Walter W. Anderson;* 2nd vice-president, *Duane Prosser;* secretary, *Albert W. Wendt;* treasurer, *Norbert Mollman;* librarian, *Paul Allison*.

Following the election, *Larry Hadlock* presented a Past President lapel pin to retiring President *Byron Bowman*, and introduced the seven past-presidents present at the meeting.

L. A. Critchfield,
Publicity Committee

Chicago Branch

The Branch held its second "Plant Visitation Day" on Friday, May 12. The members had a choice of visiting two plants, the Western Electric plating plant in Cicero, Ill. and Plant #2 of the Amphenol-Borg Electronics Corp., located in Broadview, Ill. *Dr. Russ Haar* planned the tour at Western Electric and *Joseph C. Corre* planned the tour at Amphenol. The two plants showed complete finishing operations in production electroplating at its modern best. The tours were highly educational and enlightening to everyone. The members were treated to coffee and doughnuts in the cafeteria at Amphenol after the tour. Mr. Corre and the writer conducted a question and answer period for all the visiting members of the Branch during the coffee-klatch.

The business meeting was held at Petricca's Restaurant after dinner, about 7:30 p.m. *Matt Dassinger* thanked all the officers for their help during his tenure of office. He, then, handed over the gavel to the new president, *Rudy Hazucha*, with best wishes and good luck. Rudy introduced the other officers who were present; *Joseph C. Corre*, 1st vice-president; *Art Bartman*, 2nd vice-president; *Paul Glab*, secretary-treasurer. *Charles Geldzahler*, librarian, was not present at the meeting. Three new memberships were handed to the board of managers for approval.

Christopher Marzano,
Publicity Chairman

Buffalo Branch

The Branch held its final meeting of the 1960-1961 season on Friday, May 12, at the Niagara Manor Restaurant, Buffalo, N. Y. Feature of the evening was installation of new officers conducted by Branch Past President *Roland Campbell*, in the absence of National Third Vice-President, *Frank Beuckman*. President *Harold Shapiro* had each of the present officers outline a brief description of his duties and discuss same at the group meeting. Mr. Campbell called each of the new officers forward, introduced him and gave a brief resume of the duties expected of him. Following this the past and new officers were given a rising vote of thanks.

The new officers are as follows:

President — *John Donaldson*.
1st Vice-Pres. — *Richard Davis*.
2nd Vice-Pres. — *John Tiebor*.
3rd Vice-Pres. — *Matthew Hayes*.
Secretary — *Robert Eich*.
Educational Chairman — *George Wolf*.
Treasurer — *Melvin Stachura*.
Sergeant-at-Arms — *Ray Blechinger*.
Board-of-Managers — *Harold Shapiro, Roland Campbell, John Scholterer*.

Mr. Shapiro thanked all the officers who served with him for a job well done and turned the meeting over to

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the new president who gave a brief acceptance speech and then advised that, during the new season, we will have at least one meeting in Warren, Pa. and another in Jamestown, N. Y. along with industrial tours, one of which is planned at Sylvania Electric in Warren, Pa.

Mr. Campbell stated that Buffalo was not represented at the Interim Meeting, thereby losing out on a bid for the 1967 National Convention.

Mr. Davis announced that the librarian will henceforth be titled as the Educational Chairman.

A brief discussion was held relative to the proposed increase in the per capita tax and, following this, President Donaldson closed the meeting.

R. C. Eich,
Secretary

British Columbia Branch

The regular monthly meeting was held at the Yorkshire Inn, Friday, Apr. 21, with 26 members and guests present.

The guest speaker, *Francis Eddy,* of Telautograph Corp., Los Angeles, gave a very interesting talk on job-shop organization and management, followed by a stimulating discussion period.

Branch President *Gordon Smith* presented the members of the A.E.S. training course with their certificates.

Claus Schlossareck,
Secretary

Blue Ridge Branch

The regular monthly meeting was held May 5, in the Winston-Salem Room of the Hotel Robert E. Lee in Winston-Salem, N. C. Branch President *Bruce Wallace* presided over the business meeting.

The election of officers for 1961-1962 was held. Those elected were: *Michael Milo,* president-librarian; *Carl Witherspoon,* 1st vice-president; *Roy Lewis,* 2nd vice-president; and *Donald McGee,* secertary-treasurer. Also elected to serve on the board-of-managers were: *Bruce Wallace, Walter Conine* and *Dr. Nelson Murphy.*

The Branch decided to elect a sergeant-at-arms this year. *C. M. "Moose" Butler* was elected, as the first person ever to serve in this capacity for the Branch. Two new members were elected, *Harold L. Huffman* and *William C. Huffman.*

After the business meeting those attending were taken on a tour of the cigarette manufacturing facilities of the R. J. Reynolds Tobacco Co.

Donald H. McGee,
Secretary

GERMAN SOCIETY FOR ELECTRODEPOSITION

On April 14th a group of active technical people in the electroplating and allied metal finishing field met at the Nassauer Hof Hotel in Wiesbaden, Germany to form the *Deutsche Gesellschaft fur Galvanotechnik.* Previously, groups interested in this subject had met at irregular intervals under the leadership of the late *Dr. Richard Springer,* whose sudden death was reported in the January issue of METAL FINISHING. At this founding meeting, committees were appointed and plans made for regular future meetings. For further information on the activities of the new group write *Dr. Ruheubeck,* Forschungsgesellschaft Blechverarbeitung, Postfach 10026, Dusseldorf 10.

FEDERATION OF SOCIETIES FOR PAINT TECHNOLOGY

Dr. Louis Arnold Jordan, an outstanding international authority on decorative and protective coatings technology, will present the 1961 Joseph J. Mattiello Memorial Lecture at the 39th Annual Meeting of the Federation to be held in Washington, D. C., from November 2-4, 1961.

AMERICAN SOCIETY FOR METALS

Allen G. Gray has been appointed editor of periodical publications for *American Society for Metals.* While retaining editorship of *Metal Progress,* ASM's magazine of materials and process engineering, he will now have general editorial supervision of all society periodicals, including Metals Review, Review of Metal Literature, Metals Engineering Quarterly and Transactions Quarterly.

Dr. Gray's interests include both the aerospace-nuclear applications of metals and the down-to-earth, "everyday" metals. He specialized in materials engineering and chemical aspects of metalworking and metal processing during 12 years of research and development with the duPont Co. His contributions to the nation's atomic energy development began during World War II when, on loan from duPont, he directed a group working on materials and corrosion problems for the Manhattan atomic bomb project at the University of Chicago. He also worked on special assignment with General Electric at its Knolls Atomic Power Laboratory on problems of the Savannah River Atomic Energy Plant. He is active today as a member of the Advisory Committee to the U. S. Atomic Energy Commission on Industrial Information, and holds a number of patents relating to metallurgical treatment of uranium for atomic energy applications.

After receiving his bachelor degree in metallurgy from Vanderbilt University, Nashville, he earned his Ph.D. at the University of Wisconsin, where he

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served on the teaching staff before joining duPont. He had served *Steel* magazine on part-time basis as consulting editor, 1942-1952, and joined the magazine's staff as technical editor from 1952-1957. When the late *Ernest E. Thum* was named editor-in-chief of *Metal Progress* in 1958, Dr. Gray was appointed editor.

He is editor-in-chief of the Electrochemical Society monograph "Modern Electroplating," and has been lecturer for an advanced course at Western Reserve University, Cleveland, dealing with metallurgy, electroplating and corrosion. He is author of the section on steel technology in the Encyclopedia Americana.

AMERICAN HOT DIP GALVANIZERS ASSN.

The Association, at its recent 26th annual meeting, elected *W. M. Boyles* to be its president for the current year. Mr. Boyles is president of the Boyles Galvanizing and Plating Co. of Hurst, Texas.

T. R. Gregory, president of Thomas Gregory Galvanizing Works; Maspeth, N. Y. was elected 1st vice-president.

The office of 2nd vice-president will be filled by *Cooper Hawthorne*, vice-president and general manager of Metal Services, Inc., Port Neches, Texas.

Charles E. Perry, with offices in Washington, was re-elected to the post of secretary-treasurer and *John R. Daesen* will serve as the Association's technical director.

NEW BOOKS

The Physical Examination of Metals

Edited by B. Chalmers & A. G. Quarrell. Published by St. Martin's Press, Inc., 175 Fifth Ave., New York 10, N. Y. 1960. 895 pages plus author and subject indexes. Price: $30.00.

Although the price of this book may seem high, it really is not out of line, considering its equivalence to almost three ordinary volumes in number of pages. Well printed and containing a wealth of good illustrations, the 18 chapters prepared by experts in the various phases of physical testing constitute a complete survey of the subject. Lists of references for further investigation will be found at the end of each chapter, and the subjects covered range from optical to radiographic methods, including electrical measurements, X-ray and electron diffraction, ultrasonics, and magnetic devices, a special chapter on the last dealing with coating thickness.

Practically all techniques are presented which will provide information about the properties of metals and alloys. These are described in simple terms, and little or no grounding in physics is needed by the metallurgist to understand the underlying principles. Since twenty years have elapsed since the last edition was published, advances have been sufficiently numerous to warrant revision of the original text.

Metal Finishing Dictionary; German-English, English-German

By Dr. Heinz W. Dettner. Published by Georg Siemens Pub. House, Berlin and Bielefeld, West Germany. 389 pages; DM 24; $6.00.

Whenever a means is created which helps tear down barriers to a freer exchange of ideas among technical people having different linguistic backgrounds, significant strides in technological progress and healthy cross-fertilization of scientific thinking inevitably results. Dr. Dettner has accomplished such a means with his German-English, English-German Metal Finishing Dictionary.

Though it is limited in scope to the relatively specialized field of metal finishing, the skill he has exercised in translating the terms of each language succinctly (in most cases in a single word) into that of the other, is commendable.

The dictionary consists of six main parts. These are: German-English; English-German; English abbreviations and chemical symbols; German abbreviations and chemical symbols; conversion factors—U. S. and British units to metric equivalents; Comparison of wire gages; Conversion factors —metric to U. S. and British equivalents. In addition to this, a useful set of conversion scales for current density, length, concentration and temperatures °F.-°C. are also included.

This dictionary should prove useful even to those having but a limited knowledge of scientific German, yet wish to peruse the ever increasing technical literature appearing.



June 18-23: 48th Annual Convention, A.E.S., Boston Host Branch, Boston, Mass.

June 25-30: Annual Meeting, American Society for Testing Materials, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J.

June 26-27: 5th Annual Conference on Vacuum Metallurgy, American Vacuum Society and New York University, Co-Sponsors, University Heights Campus of N.Y.U., New York City.

July 22: Annual Stag Day, Detroit Branch A.E.S., Glen Oaks Country Club, Farmington, Mich.

July 31-Aug. 4: Gordon Research Conference on Electrodeposition, Tilton School, Tilton, N. H.

Sept. 5-8: 11th National Chemical Exposition, Chicago Amphitheater, Chicago, Ill.

Oct. 1-5: Fall Meeting, The Electrochemical Society, Hotel Statler, Detroit, Mich.

Oct. 16-19: 2nd International Congress on Vacuum Technology, Sheraton Park Hotel, Washington, D. C.

Oct. 23-27: 43rd National Metal Show and Congress, American Society for Metals, Cobo Hall, Detroit, Mich.

Nov. 2-4: 39th Annual Meeting, Federation of Societies for Paint Technology, Washington, D. C.

Dec. 1-2: Annual Educational Meeting and Banquet, Detroit Branch A.E.S., Statler-Hilton Hotel, Detroit, Mich.

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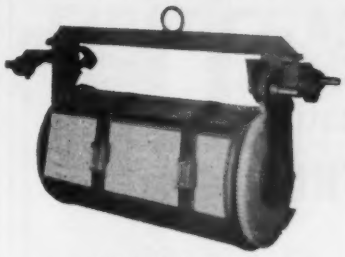
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HVWM Copper-Nickel-Chrome. Double Lane Rack 44" x 28" x 10"
LASALCO Daw Jr. Finger Type-Zinc. Rack 12" x 2½" x 1"
STEVENS Model C-Zinc-Double Lane. Rack 38" x 36" x 5"
UDYLITE Chrome-Single Lane. Rack 64" x 24" x 10"
UDYLITE Anodize-Single Lane. Rack 54" x 24" x 16"
UDYLITE Double Acid Copper. Single Lane. Rack 36" x 18" x 8"

BUFFING JACKS

23—HAMMOND (like new) Variable Speed 3 - 5 - 7½ - 10 HP
5—STANDARD Variable Speed 3 HP
60—Buffing Jacks 3 - 15 HP

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1—DETREX Model S-50, Steam heated, 50 gal. an hour
3—DETREX Model S-60, Steam heated, 60 gal. an hour

10' HOIST LINE — SPECIAL
COPPER-NICKEL-CHROME Hoist Line
36 Tanks 10' x 3-4' x 6' deep
Complete with powered trolly hoists

GENERATORS

3—7500/3750 Amp. 9/18 V. 25°
2—10,000/5,000 Amp. 24/48 V.
1—10,000/5,000 Amp. 12/24 V.
1—7,500/3,750 Amp. 6/12 V.
1—6,000/3,000 Amp. 6/12 V.
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COPPER BUS BAR

83,000 lbs. Copper Bus Bar ¼" x 4"
5,000 lbs. Copper Bus Bar 1¼" Dia. & Sq.

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2—INDUSTRIAL Lined 30 x 6048, 6,000 GPH
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25—Degreasers, all sizes
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21—Plating Barrels
25—Blowers, Various sizes
16—Assorted Tumbling Barrels
11—Tanks 19' x 3' x 4' deep. NEW
2—Rubber lined 10,000 Gal. Storage Tanks
4—Air Agitation Blowers
1—ALMCO Sub-O-Matic 8 Station Submerged Barrel Finishing Automatic
14—Various Sizes — Dust Collectors

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We were just too darn busy to advertise another

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1—Rebuilt Grav-I-Flo Model 48-2, ½" lined, 20 RPM Deburring and Burnishing Barrel. Each compartment 24 x 40. Unit driven by a 5 HP, 220/440/3/60 cycle Synchrogear Motor. Complete with Reversing Switch and 1 Tri Cycle Hoist Pan.

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NOTE: Our apologies go out to the great number of people who were too late in calling for the Udylite Rectifier as advertised in May.



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- STRAINS PAINTS AND VARNISHES AS YOU SPRAY
- Consult Your Paint Dealer or Order Direct From Factory in Lots of 12
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1 Koroseal lined steel tank. Width 5', depth 4', length 12'. Submit particulars to:

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Packer 4-24 continuous rotary automatic buffer: 3 - 5 h.p. heads, 24 spindles, automatic compound applicators. Good condition — must sell.

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WANTED

Plating generators, total of 90,000 ampere. 5000 Amps. min. per generator 12 volt.

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SITUATION OPEN—Shop in Piedmont section of North Carolina desires experienced man on rack work, chromium, cadmium, copper, chromating. Must know metal finishing and be able to analyze and correct solutions. Send resume. Address: June 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

PLATER

SITUATION OPEN—Plater wanted who can take charge in small shop doing specialty work in the aircraft, missile and electronic field. Salary open. Located in Boston area. Address: June 2, care Metal Finishing, 381 Broadway, Westwood, N. J.

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PLANT SUPERINTENDENT

SITUATION OPEN—Plant superintendent wanted with experience in plating and anodizing job shop. B. S. degree in chemistry desirable. Salary open. Give full particulars. Located North Central United States. Address: July 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

SALES MANAGER, ELECTROPLATING EQUIPMENT

SITUATION OPEN—Well established manufacturer of filter pump systems seeks a thoroughly experienced sales manager to handle all phases of sales, sales promotions and advertising. He must be thoroughly experienced to handle direct customer contact as well as act as liaison with advertising agency and should be experienced originating sales letters and sales promotion pieces. Address: July 6, care Metal Finishing, 381 Broadway, Westwood, N. J.

SITUATIONS WANTED

FINISHING MANAGEMENT

SITUATION WANTED—Management position wanted by high caliber man in manufacturing plant or large job shop. Widely experienced to handle all phases of management including personnel, union relations, solutions and equipment. Chemistry degree; plant and product responsibility. Will relocate. Resume principals only. All inquiries answered. Address: June 11, care Metal Finishing, 381 Broadway, Westwood, N. J.

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SITUATION WANTED—Twelve years experience in analyzing and maintaining solutions, production and plant maintenance, plating to Government specifications, barrel and still plating on precious metals, as well as trouble shooting. B.S. in chemistry, also graduate metallurgical courses. Address: June 9, care Metal Finishing, 381 Broadway, Westwood, N. J.

PLATING EXECUTIVE

SITUATION WANTED—Thirty years experience, capable of full responsibility. Can set up and get out production on all types of plating including anodizing and oxidized finishes. Can maintain and analyze solutions of all types. Only interested in metropolitan area of New York City. Address: July 5, care Metal Finishing, 381 Broadway, Westwood, N. J.

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SITUATION WANTED—Sales executive invites association with company seeking man of seasoned judgment. Result-getting experience developing markets for machinery components, supplies. Background includes advertising, direct mail, forceful sales letters. Address: June 10, care Metal Finishing, 381 Broadway, Westwood, N. J.

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JULY, 1961 NUTLEY 10, NEW JERSEY No. 11

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An extra high purity gold electroplating process, TEMPEREX HD, meets or surpasses the most exacting finishing specifications required by manufacturers of transistors and other electronic components. The new process produces deposits of 99.99+ purity, affording a uniformity of metallurgical characteristics never before attainable in gold electroplate.

Other advantages offered by TEMPEREX HD electroplates include: hardness — 75 Knoop, substantially greater than coatings produced from conventional or so-called "24 karat" cyanide formulations; remarkable ductility — TEMPEREX HD electroforms can be cork-screw twisted without fracturing, important to the function and reliability of crimp-type connectors; exceptional machineability — no foreign codeposits to pit out during machining, important in slip rings and other applications where machining is performed subsequent to plating; easy soldering or welding — as necessary in the bonding of silicon directly to gold plate.

There appears to be no practical limitation of thickness — *electroforms* to 30-thousandths of an inch are easily produced under commercial operating conditions. TEMPEREX HD electroplate also exceeds the requirements of such standard electronic product-acceptance tests as exposure to 550°C /10 minutes; 300°C /96 hours in air.

Ask for TX-HD for details.

PRINTED CIRCUIT PLATING IMPROVED BY NEW OXIDE-REMOVING "DIP"



Electroplating on to copper and copper alloy printed circuits is substantially improved by DEOXYDE, which removes oxides, light soils, fingermarks and similar plating deterrents, through a simple dipping operation.

Ask for DX-1 for technical data on this product of the Chemical Division, The Meaker Company.



COMPACT PRECIOUS METAL PLATER FOR JEWELRY AND ELECTRONICS

A compact plating unit measuring only 30" x 26" x 18" to the work top contains all the equipment and features for precision-plating of jewelry, electronic parts, or specification precious metal plating, on a prototype basis. This newly designed smaller version of the Sel-Rex Jet Plater permits either barrel or rack plating with any room temperature alkaline solution, and specifically, acid gold plating solutions.

The new Junior Jet Platers provide the ideal operation for small scale precision precious metal plating for the electronic and jewelry industry. A plastic centrifugal pump in conjunction with a vinyl, jet orifice manifold at the bottom of the plating tank, causes the plating solution to swirl constantly around the work, assuring smooth, even deposits. In operation, the solution is continuously drawn off from the bottom of the tank, circulated through the pump and built-in filter, and returned to the tank under pressure.

All operations are controlled from a convenient panel board which incorporates dual scale ammeter, step-less control for rectifier, circuit breakers, voltmeter, and automatic timer which sounds alarm upon completion of plating cycle.

For additional information on this space-saving, sample or prototype plating "package" manufactured by The Meaker Company, subsidiary of Sel-Rex Corporation, ask for JJP-1.

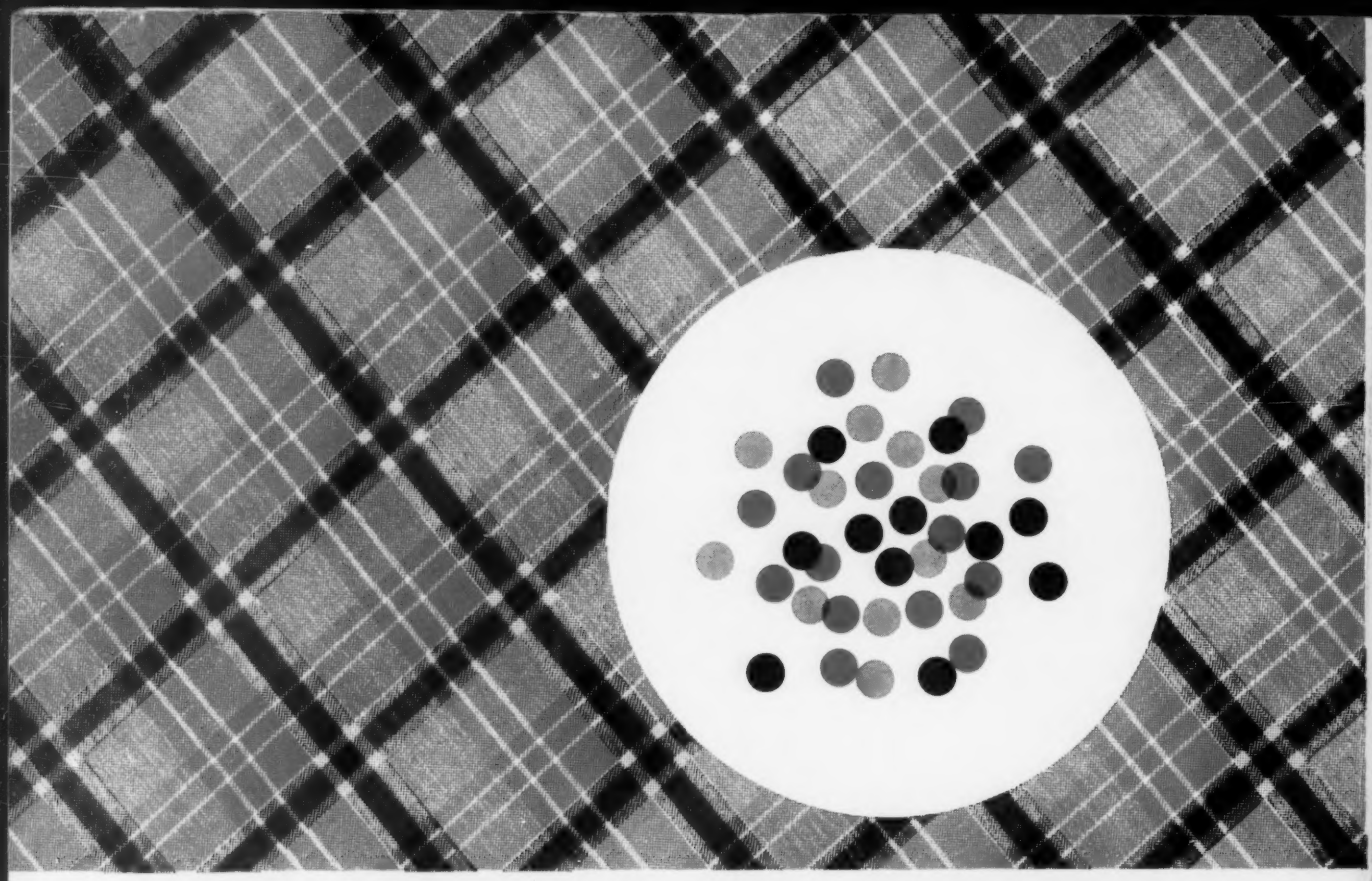
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A wide range of machines and equipment designed to automate metal finishing operations is described in a fully illustrated 29 page "Guide", entitled WHEN TO AUTOMATE. Featuring photographs of actual installations — including the world's largest electroplating facility — the new booklet provides profit-increasing ideas for large or small firms contemplating automation.

WHEN TO AUTOMATE suggests type of automatic equipment useful to electronic firms for mass production processing of vital components. Extensive and detailed tables show: electrochemical equivalents of base and noble metals; data on depositing zinc, copper, tin, nickel, cadmium and chromium; and separate tables for use with acid, cyanide and other recommended solutions.

The extensive booklet suggests answers to its title WHEN TO AUTOMATE for all concerns involved with metal finishing, electroplating, anodizing, and other processes requiring a sequence of metal finishing operations.

Request MA-1 for your copy of this Guide, published by The Meaker Company, subsidiary of Sel-Rex Corporation.



MacDermid Makes Spotting-Out Problems

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- Cyanide spotting-out of electroplated parts is always a tough problem — but especially in summer when the humidity climbs.
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